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Single Army Logistics Enterprise

Overall Army Logistics Enterprise Solution Report - Final

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Chapter

1 Executive Summary

The Army enterprise vision is "A fully integrated knowledge environment that builds, sustains, and generates, warfighting capability through a fully integrated logistics enterprise based upon collaborative planning, knowledge management, and best business practices." To achieve this vision, the Army must be aligned so that the SAP software solution is optimized over "value chains". This will enable the Army to maximize their support to the warfighter customer with minimum investment dollars and resources. The business processes should be included inside the ERP solution boundaries without interfacing to leverage the benefits of integration. For the Army, the aligning of solution boundaries to preserve the integrity of the ERP software is a critical issue; i.e., costly Army-to-Army interfacing should be avoided whenever possible. For this reason, architectural planning is an absolute requirement.

We document the Army Logistics Enterprise as an integrated business process domain that aligns with the Future Logistics Enterprise (FLE). After aligning with the FLE, we perform a gap-fit of the FLE-aligned business process architecture against the SAP Reference Model and its extensions. Hence, we develop a three-way mapping from Army Logistics to the Future Logistics Enterprise to the SAP standard software solution.

With this study, we have aligned the Army logistical enterprise with a single solution that is value chain based with fully integrated business processes. The primary integrating concept is Total Lifecycle Systems Management (TLCSM), as required by OSD guidance. In addition, other strategic directives such as End-to-End Customer Service and Conditions Based Maintenance (CBM) – plus (+) are also addressed in the architecture. The architecture is fully compliant with the Future Logistics Enterprise, and; therefore, fully compliant with the logistics requirements in the FMEA architecture, since these requirements are the same. Full compliance with the FMEA should result if the same disciplined approach is followed.

The details of the architecture are presented in the body of the report, including the logic of the business process orientation for alignment with commercial ERP software. Our major finding is that the business processes across the national and field Army are totally integrated, particularly in the area of product lifecycle management (i.e. technical data management, configuration management, document management, etc.). For example, technical data originates through a collaborative relationship that involves the weapon system program office and the Original Equipment Manufacture (OEM). This same technical data is used by the national Army to support sustainment operations, as well as the field Army while in garrison and deployed in theater. There is critical feedback at all levels of the technical data management process. This feedback begins at the platform level and flows to all levels of the organization, including a complete feedback to the OEM. Using the operational architecture created for the Army, we have demonstrated this requirement. The associated systems architecture that was produced has been structured to enable these types of critical business process requirements.

Given the level and complexity and degree of interdependence across the multiple levels within the Army, we have provided recommendations to address governance as a part of institutionalizing the single Army solution. Our experience shows that independently

managed ERP (SAP) projects lead to independent and disparate solutions. This conclusion is validated by Gartner research – it is addressed in detail within the report. The national and field Army solutions are very dependent; therefore, independent configurations with independent contractor teams will not lead to an integrated solution for the Army. We can demonstrate the dependencies and the complexities using the architecture. The related issues are discussed in the report. A single Army focal point for ERP implementation management is required, and this single Army focal point needs a staff, a detailed build plan (i.e., architecture), and an enforcement mechanism. Since TLCSM is a core logistics function, and given the Vice Chief's memorandum of 1 June 2000, the obvious focal point is the Office of the Deputy for Army Enterprise Integration (DAEI). However, this office needs funding to manage and coordinate all ERP and related EI implementations.

We are recommending that a Strategies, Architectures, and Standards Group (SAS-G) be established. Their primary objective will be to develop the on-going details of the architecture as well as maintain the integration build-plan. The SASG should report to the Executive Steering Group (ESG), with oversight and management conducted by the DAEI. We provide detailed recommendations on how the Office of the DAEI maintains and manages the SASG, including how all EI implementations must demonstrate architectural compliance prior to receiving permission to proceed through implementation methodology milestones. The enforcement mechanism must come from the senior leadership, including the CG of AMC, and his personally selected Executive Committee in support of the DAEI. For logistics implementation projects, the guidance seems clear on these issues, and we think that such central control is an absolute necessity. Our experience shows that successfully executing against the enterprise architecture is an extremely difficult and challenging task. There are many pitfalls that can derail even the "best laid plans." If the Army fails during execution, it can be sure that higher level oversight will intercede once again.

Assessments by the Gartner Group on Best Practices in ERP deployment and the associated cost / benefit data have also been provided. Applying best practices can significantly improve the Army's ability to field a successful Logistics ERP program. In this report we address the three organizational critical success factors that consistently make or break an ERP architecture initiative. These factors include:

- The Right Governance Model
- Organizational Change Management
- The Architecture Team Structure.

Suggested actions are placed with each recommendation to assist the Army as it addresses how to incorporate these best practices into its environment.

The Army logistics applications and systems are moving across enterprise boundaries, which mean that business process ownership is pivotal in facilitating collaboration within the Army and among other enterprise stakeholders. Collaboration requires integration, and integration requires a comprehensive understanding of business processes. A network of business process owners across the enterprise can provide input to the development of the standard work processes and solution sets. This also allows innovative thinking and organizational differences to be captured at initial design, rather than handled as exceptions during implementation.

Additional findings and recommendations are listed below. For each item listed there is a more detailed section within the report that provides additional background and analysis to support the published recommendation.

- The Army should avoid customization of their SAP solutions (or any packaged software for that matter). The Army should instead focus on reengineering their business processes to align with the software solutions and its embedded best practice processes. This trade-off is cheaper in terms of avoiding software development costs, long-term support costs, and upgrade costs. In addition, a lack of customization will also enable the Army to drive their architectural design towards a single solution and in turn enhance its investment. This recommendation seems trivial, but it is directly related to our next recommendation.

- The LMP project began as a system replacement project for two legacy systems. Given the integrated nature of ERP software, this is an unusual scoping for an SAP project; (i.e., ERP is usually scoped to align with and maximize the value of business process domains). There is a similar approach being taken for GCSS-A (i.e., replace 13 tactical systems). For both LMP and GCSS-A, some of the business processes are unique to national Army and the field Army respectively, and are not part of an overall Army and/or DoD business process. However, some of the business processes from both projects are a part of a national (Army and DoD) business process domain. This makes the projects dependent on each other, other existing DoD systems, and all future system (SAP and other) implementation projects. There is a rare opportunity and a critical requirement to re-baseline the scope and contracts of the national and GCSS-A domains and pull all of the relevant business processes into the integration domain. This will help ensure the Army maximizes its return on investment. As a first step to achieving end-to-end business process integration, the GCSS-A blueprint should be mapped to the business process architecture prior to entering the realization phase of the project. For GCSS-A, permission to proceed to the realization phase should depend on the ability to demonstrate how the blueprint enables the integrated value chain architecture. Likewise, the details of the LMP scope [using an updated Business Process Master List (BPML)] should be mapped to the business process architecture prior to the funding of any future SAP extensions. For the national level, all scope extensions should also be based on a clear demonstration that the effort extends value chain integration. All integration-related contracts should be re-baselined to support this concept. Permission for scope extensions should also apply to all major non-SAP implementations as well. We recommend that GCSS-A and LMP be allowed to proceed with the above conditions attached.

- Product Lifecycle Management (PLM) is a critical Army business process. The architecture demonstrates that PLM is an end-to-end business process that flows across all levels of the Army, and it also interacts with the weapon system OEMs. In the Army today, the PLM process is disconnected and incomplete. In the architecture the PLM business processes are completely integrated with those business processes that are enabled by SAP; hence, the PLM business processes must be managed as part of the overall Army integration effort. The Army's ePDM effort should be realigned as an end-to-end business process that is implemented jointly with all other business processes in the Army integration domain. This implies that ePDM and ERP cannot proceed as independent projects. If they are allowed to proceed independently, technical data integration for the Army will not occur. On the management side, PDM implementation and all variants there-of should be managed by the Office of the DAEI in accordance with the architectural guidance of the SASG.

- The IDE is an Enterprise Application Integration (EAI) entry point into DLA. The objective of the IDE is to "provide an enhanced environment that enables the DoD Logistics Enterprise to execute practices, processes, applications and decision support tools to achieve logistics interoperability and allow for information exchange within and between internal and external DoD business partners." The vision includes:

    - "Non-system dependent transactions,
    - Consolidation and reuse of interfaces,
    - Data integration/sharing, and
    - Leverage modernization efforts."

In the report we demonstrate that the Army architecture is aligned with the vision of the IDE, as we understand it from the documentation that we have been provided.

- Logistics chain efficiency comes from making good decisions based on accurate knowledge. There is always an inherent tension between the cost of gathering the data and the measurable improvement in efficiency, operational needs, etc. The US DoD is moving toward CBM+ (as requited by the Future Logistics Enterprise), with more accurate predictions of impending failures based on condition data. Implementation should result in dramatic savings and improved weapon system availability to meet Combatant Commanders' requirements. CBM+ focuses on inserting technology into both new and legacy weapon systems that will support improved maintenance capabilities and businesses processes. It also involves integrating and changing business processes to improve logistics system responsiveness. Under consideration are capabilities such as enhanced prognosis/diagnosis techniques, failure trend analysis, electronic portable or point of maintenance aids, serial item management, automatic identification technology and data-driven interactive maintenance training. The ultimate intent of this initiative is to increase operational availability and readiness throughout the weapon system life cycle at a reduced cost. In our report we address several relevant integration scenarios. Through our high level analysis it appears that SAP can support these integrated scenarios, however there are a number of issues that must be worked by the Army before the scenario can be implemented.

    1. Industry and the Army must insert enhanced diagnostic & prognostic engineering capability into both new and legacy weapon systems to support improved logistics processes,
    2. The Army must adopt the MIMOSA XML standard for the exchange of condition data between the weapon platform and business applications,
    3. The Army must adopt the SAP Open Catalog Interface XML standard for interfacing the IETM parts catalog (part of the Repair Parts & Special Tool List) and SAP business applications, and
    4. The Army must develop an XML standard for the exchange of maintenance items between the IETM and the SAP business applications.

- It is essential during deployments and exercises to be able to carry out the logistics and administrative core processes of an organizational element independently of the connection to a central SAP system. The fundamental requirements for detached and mobile operations can be expressed as:

    — Model the personnel and materiel structures for the Army in the system,

- Support the Army's missions in all phases of deployment operations,
- Highly available IT functions that promote self sufficiency,
- Planning, buildup, deploy and support of Army contingents,
- Organizational flexibility, and
- Integrated with the associated business processes, such as finance and human resources.

- Our instructions in developing the architecture was to focus on technologies that well be mature in the 2006-2008 range, and not only focus on technologies that are mature today. The SAP mobile engine is not mature today, but it will be mature in the 2006-2008 range. Of course, the big benefit is that the SAP Mobile Engine is completely integrated with the Single Logistics Enterprise solution. It is not interfaced, and it is not platform dependent. Our bias is always in the direction of integration as opposed to interfaced proprietary platform-specific devices, as long as business process requirements are met. We recommend that the Army engage the SAP development team to influence current development efforts, through this process, ensure that U.S. Army requirements are met.

- The critical system architecture component is an intelligent hub that manages technical and other data. We are recommending that the hub be implemented using SAP technologies. More specifically, we suggest NetWeaver, Master Data Management, and SAP PLM, with the exchange infrastructure providing an optimal messaging engine across SAP domains and an Enterprise Application Integration (EAI) broker across external domains. This concept is explained in detail in the body of the report, but as a short summary, this alignment provides:

    - Optimized messaging across all SAP domains, including GCSS-A and LMP.
    - Master data control at a single Army location,
    - A single point for interfacing with all external constituents, including DFAS, DLA, and weapon system OEMs,
    - Centralized repository management for all technical data, and
    - Complete feedback to the OEM or any Army level for prognostic and diagnostic data.

  The NetWeaver/MDM/PLM solution is a separately configured SAP solution (single IMG), and it is managed by the Office of the Army DAEI.

Throughout this report recommendations have been made to integrate the Army's logistics environment and leverage the solutions chosen by the Army. As a part of our study task we also produced a high level integrated schedule. Each aspect of the schedule has been analyzed to ensure the Army leverages from the existing work performed and that it takes advantage of future product capability. We believe the integrated schedule helps position the Army Logistics Enterprise to be better prepared for the critical Army transformation that will take place.

Chapter 2

Introduction

Background

The Army logistics system is a complex series of processes, organizations, doctrines, procedures, and automated systems. Historically, the system has been separated into two management levels: wholesale, which typically includes Army Materiel Command (AMC), Defense Logistics Agency (DLA), and the industrial base; and retail, which includes all customer organizations at theater and below. Doctrinally however, the system is segregated into three levels: strategic, operational, and tactical. In recent years, decisions have been made to enable these domains using commercial standard software whenever appropriate.

Overview of Tasking

The SAP Domains

The Army has two SAP domains. One of these domains is in the planning stages, and the other is in the realization phase.

Global Combat Support System – Army (GCSS-A)

The GCSS-A is a sub-component of the GCSS family of systems, a broader effort aimed at enhancing combat support through system interoperability. The Army system will eventually be integrated with the national-level modernized logistics system. Specifically, through GCSS-A, the Army will fold the service's 13 legacy logistics systems into an integration domain and interface them with the rest of the Army enterprise environment -- personnel, financial, medical and other non-logistics CSS functions, as well as the external Defense Department environment. The decision has been made to enable the integration domain for GCSS-A through the implementation of commercial standard software. It is important to note that even though the decision has been made to move forward with SAP, this project is still in the planning stages.

Logistics Modernization Program (LMP)

The LMP project requested that a contractor provide application services to replace the wholesale logistics functions supported by Commodity Command Standard System (CCSS), Standard Depot System (SDS), and other specified systems and subsystems. The original tasking has been extended through additional delivery orders, including a significant extension of the application services to include Single Stock Fund (SSF) capabilities. While LMP is a significant enabler of the national integration domain, the original contract was not scoped to leverage the full capabilities of SAP.

SAP projects are initiated to align business process domains with a single integrated software solution. The LMP project was initiated to replace two information systems. If you

retire legacy systems and replace them with ERP, you must also replace interfaces to other affected systems. This does not permit the flexibility that the implementation consultants need to leverage the end-to-end capabilities of the software. The same logic applies to GCSS-A. It is currently scoped as a system replacement project; i.e., thirteen tactical systems are targeted for replacement. With enterprise software, scope is defined in terms of business processes, not systems.

Our architecture indicates that the national and field Army[1] domains should be rescoped to include all relevant business processes and data that are required to achieve true integration (not interoperability). The extended integration domain contains a number of additional business processes, but most importantly, the Product Lifecycle Management business processes must be included. These extensions are explained in detail in a later section.

Approach

Details of the Approach

Enterprise Architecture Planning is the process of defining and documenting a plan (i.e., a blueprint0 for the use of information in support of the business processes of an organization. Enterprise Architecture Planning also includes the plan for implementing against the requirements as documented in the architecture. Enterprise Architectural Planning is a business responsibility that is executed by line personnel within the organization. Technologists play a supporting role, but they should never be given the task of developing the enterprise architecture.

For logistics, the logic is as follows. The policy is extant within various documents related to the Future Logistics Enterprise. These are written documents with ambiguity sufficint enough to invite interpretation. These documents must be transformed into a more precise representation that minimizes the opportunity for alternative interpretations. This output of this transformation process is the policy architecture, which,in the case of the DoD, is the DUSD (L&MR) Future Logistics Enterprise Architecture. This architecture is a model-based representation of the policy. This model (i.e., architecture) describes how OSD requires Components and the Agencies that the policy be implemented by the.

At the Army level, the OSD policy architecture is a constraint on logistics business processes, and therefore also on logistics systems. The Army logistics architecture is implementation architecture. It must provide a plan for implementing the policies in the OSD logistics architecture, while simultaneously considering any constraints that are imposed from other sources. The implementation architecture designs the to-be business processes, and it is also used to align the software solution with the business processes.

Following this logic, the approach is as follows. The OSD policy architecture resides at the highest level. It bounds the Army's implementation architecture, which resides at the component level. The system architecture enables the dominant business process architecture. The value added from the architectural team is the ability to:

[1] We used the term field Army to include garrison and deployed forces. We use this terminology to reinforce the requirement that separate solutions for garrison and deployed are not acceptable.

- Translate written policy into models.
- Conceptualize and document inter- and intra-organizational business processes, subject to policy constraints, and
- Align extended enterprise solutions with the business process architecture.

The aforementioned hierarchy is accomplished utilizing "views," with each organizational participant only having access to information enabled within their view. For the U.S. Army, the Single Army Logistics Enterprise Architecture is the implementation architecture.

Summary of Approach

We document the Army Logistics Enterprise as an integrated business process domain that aligns with the Future Logistics Enterprise (FLE). After aligning with the FLE, we perform a gap-fit of the FLE-aligned business process architecture against the SAP Reference Model and its extensions. Hence, we develop a three-way mapping from Army Logistics to the Future Logistics Enterprise to the SAP standard software solution.

This mapping is integrated in a single repository, and is displayed in accordance with C4ISR Architectural Framework views at various levels of decomposition. Since all architectural objects are linked across views, configuration management is guaranteed.

Architectures are used to address issues, questions, and problems. For example, when questions are posed the architecture is used to analyze the facts as documented as opposed to using qualified opinion decision criterion,. If logic errors are identified, the architecture is updated and the cycle is repeated. For the detailed issues that are specified in our SOW, we properly structure the issues as questions, and then we use the architecture to help us answer the questions. The following is a representative list of questions:

1. How should PDM be executed by the Army to leverage the investment in SAP? How do our architectural recommendations relate to those of the Log Transformation Task Force?
2. How should transportation/distribution be executed in the Army in order to leverage the investment in SAP, while simultaneously meeting the OSD requirements for End-to-End Customer Service?
3. How do national and field (garrison & deployed) Army business processes interact?
4. How is Performance Based Logistics executed in the architecture?
5. How is end-to-end asset accounting ensured in the architecture?
6. Where does Total Lifecycle System Management (TLCSM) align with the architecture?
7. How does the US Army Medical Materiel Agency (USAMMA) fit into the architecture? USAMMA provides medical supplies (they are DLA managed

items) as the PM for the Army. They use DAASC to get the info they need, and they are not part of AMC.

8. How does property book accounting at the field level of the architecture interact with the national level of the architecture? How does this relate to the SAP equipment master? What are the implications of this linking for splitting the implementation domain into two independent projects?

9. How does the transition architecture relate to LCOP?

10. How does the architecture accommodate the DLA IDE initiative?

11. How is "fuel" handled in the architecture?

12. There is an assertion that the masters from LMP will be replicated at GCSS-A and centrally managed at a NetWeaver. How will master data be replicated from LMP to GCSS-A? Is the master data in LMP sufficient to enable GCSS-A? Will additional master data be required to meet the configuration requirements of GCSS-A?

13. This question relates to the mobile engine. What does replication mean across four levels: LMP, PLM+, GCSS-A, and the mobile client? What has to be replicated, and what does it mean for master data, transactions, and business processes? SAP says that the data and the transactions must be identical, but the business processes only have to be "consistent." What does consistent mean?

14. How does Force Element relate to the front end of the GCSS-A value chain? That is, when there is a task organization change, the log tail changes. Hence, there must be some relationship to the C2 systems, and hence the solution is classified. How can task organization be completed without enabling the complete GCSS-A value chain?

15. How will we deal with security in the SAP environment? Is this as simple as "flipping a switch" when classification is required?

16. How will SAP support joint task force composition and the support of coalition forces?

17. DLA systems currently know where a unit is supported by a particular SSA. When there is a task organization change, and the unit is moved, DLA no longer has visibility into the location of the unit; hence, it cannot support from the new SSA. Is it possible to transfer the task organization information to DLA. How will that be managed under E2E Customer Service?

Recommendations

- The Army should avoid customization of their SAP solutions (or any other packaged software for that matter). The Army should instead focus on reengineering their business processes to align with the software solutions. This trade-off is cheaper in terms of avoiding software

development costs, long-term support costs, and upgrade costs, but a lack of customization will also enable the Army to drive their design towards a single solution and in turn enhance their investment. This recommendation seems trivial, but it is directly related to our next recommendation.

- The LMP project began as a system replacement project. This is an unusual scoping for an ERP project; ERP is usually scoped to align with and maximize the value of business process domains. There is a similar scope for GCSS-A; i.e., replace 13 tactical systems. For both LMP and GCSS-A, some of the processes are unique to national Army or the field Army respectively, and are not part of an overall Army and/or DoD business process. However, some of the business processes of both projects are a part of a national (Army and DoD) business process domain. This makes the projects dependent on each other, other existing DoD systems, and all future system (SAP and other) implementation projects. Now, there is a rare opportunity and a critical requirement to re-baseline the scope of the national and GCSS-A domains to pull all relevant business processes into the integration domain to ensure the Army can maximize its return on investment. As a first step to achieving end-to-end business process integration, the GCSS-A blueprint should be mapped to the business process architecture prior to entering the realization phase of the project. For GCSS-A, permission to proceed to the realization phase should depend on the ability to demonstrate how the blueprint enables the value chain architecture. Likewise, the details of the LMP scope [using an updated Business Process Master List (BPML)] should be mapped to the business process architecture prior to the funding of any future SAP extensions. For the national level, all scope extensions should be based on a clear demonstration that the effort extends value chain integration. All integration-related contracts should be re-baselined to support this concept. Permission for scope extensions should also apply to all major non-SAP implementations as well. Our experience with prior and current DoD SAP implementations has taught us that legacy system designs sometimes create the need for SAP design and coding modifications in order to interface SAP with these legacy systems. These coding modifications lead to customization of the SAP software, which could marginalize the Army's benefits realization in national business process domains.

- Product Lifecycle Management (PLM) has emerged as a critical Army business process. The architecture demonstrates that PLM is an end-to-end business process that flows across all levels of the Army, and it also interacts with the weapon system OEMs. The PLM business process is completely integrated with those business processes that are enabled by SAP; hence, the PLM business process must be managed as part of the overall Army integration effort. The ePDM effort should be realigned as an end-to-end business process that is implemented jointly with all other business processes in the Army integration domain. This implies that ePDM and ERP cannot proceed as independent projects. If they are allowed to proceed independently, technical data integration for the Army will not occur. We are not prepared to make a technical recommendation

about whether all product data should be included in SAP at this time, but a recommendation on this issue will be made in the final report.

- The critical system architecture component is an intelligent hub that manages technical and other data. We are recommending that the hub be implemented using SAP technologies. More specifically, we suggest NetWeaver, Master Data Management, and SAP PLM as an optimal messaging engine across SAP domains and an Enterprise Application Integration (EAI) broker across external domains. This concept is explained in detail in the body of the report, but as a short summary, this alignment provides:

    - Optimized messaging across all SAP domains, including GCSS-A and LMP.
    - Master data control at a single Army location,
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  The NetWeaver/MDM/PLM solution is a separately configured SAP solution (single IMG), and it is managed by the Office of the Army DAEI.

Chapter

3 Value Chain Integration

The Army enterprise vision is "A fully integrated knowledge environment that builds, sustains, and generates, warfighting capability through a fully integrated logistics enterprise based upon collaborative planning, knowledge management, and best business practices." To achieve this vision, the Army must be aligned so that the SAP software solution is optimized over "value chains". This will enable the Army to maximize their support to the warfighter customer with minimum investment dollars and resources. The business processes should be included inside the ERP solution boundaries without interfacing to leverage the benefits of integration,. For the Army, the aligning of solution boundaries to preserve the integrity of the ERP software is a critical issue; i.e., costly Army-to-Army interfacing should be avoided whenever possible. For this reason, architectural planning is an absolute requirement.

In this chapter we demonstrate, using some critical business processes, why the preservation (as a single solution) of the SAP business process logic is so important. We select two critical areas that are examined in detail using the architecture and argue that it is impossible to consider the national and field Army levels as independent SAP projects. With two case studies, product lifecycle management and asset tracking, we show that the SAP integration flows across both domains.

Integration and Enterprise Resource Planning

Implicit within the term Integration is the requirement that all relevant data for a particular domain is processed in the same application instance. An instance of an application includes the software application, complete with its servers, which share a common system profile and business process logic; i.e., a separate installation of a software solution. Updates in one application module are reflected throughout the instance with out interfacing. On the other hand, Interoperability provides the rules, formats, and business processes required to pass data, commands, events or messages between solution applications.

Implementation domains are seldom fully integrated. On one end of the spectrum is the "family of systems" approach, in which all systems are interoperable. On the other end of the spectrum is a self contained ERP implementation with no interfaces; i.e., fully integrated. Most domains fall in between, with some business processes being integrated and others supported by interfaces to other systems. The Army falls in this latter category, since interfaces to some systems/organizations are mandated by law, e.g., DFAS or SPS.. Hence, pure integration is desirable but impossible to achieve.

The SAP R/3 system is delivered as componentware. When the basis layer is implemented a complete scope of R/3 functionality is available, and each module is activated as required by the scope of the implementation. The business processes and data are engineered as part of the integration[2]. Any un-natural divisions of these business

2 Please note that this is true integration, not interoperability.

processes result in an artificial “break” in the data and business process architectures. For example, since production units are aligned with cost, if sub-functions of Production and Planning (e.g., MRP) are removed from the solution, then complex interfacing is required in order to make the software work as a complete solution. The current divisions in LMP to align with the systems that were contractually replaced are good examples of this type of business process divisions.

Keller and Teufel (1998) provide the business process functionality of a core SAP solution as implemented across an organizational entity. If the business process functionality is divided for any reason, then to provide a complete domain solution, the functionality must be re-combined. This recombining is complex and costly; hence, our bias is always in the direction of preserving the integration domain. We are pragmatic from an architectural point of view,. As previously noted, some interfaces are impossible to avoid, but in general, we always seek to minimize Army-to-Army interfaces. This defines a fundamental premise of the Army Logistics Architecture: Integration is always preferred over interoperability.

Aligning Business Processes with Commercial Software

This section presents our general approach for aligning the architecture with commercial software products. Since the Army has selected SAP as the product to support the national and field Army implementations, the study focuses on the SAP software solution. However, we do note the following: We would follow the same procedures If the solution were different than SAP..

SAP defines the mySAP Business Suite as “an open collaborative business environment of personalized solutions that are provided on demand. It is a comprehensive basket of offerings that includes Internet-enabled applications, such as the Web-enabled core components of SAP R/3, new enterprise and collaborative business scenarios, the personalized Workplace as enterprise portal, the Marketplace as a global e-business hub, and services like application hosting. It is a real-time, collaborative, business solution environment.”

Since our defined domain is logistics, the primary components for consideration are core R/3, Supplier Relationship Management, Product Lifecycle Management, and Supply Chain Management, including the Advanced Planning Optimizer (APO). Other components, as appropriate, will be mapped to the architecture. Our objectives for the mapping are as follows:

- Search for business process gaps in the current solution that must be filled in order to achieve an integrated solution while meeting FLE requirements. Analyze these gaps against future announced releases by SAP, and for those that are not announced, use appropriate venues to bring them to the attention of the software vendor.

- Search for business rule gaps that are caused by specific DoD requirements or anticipated business rule gaps that are caused by emerging FLE or other DoD policy, statutory, and regulatory requirements. Bring these gaps to the attention of appropriate government personnel and the software vendor.

- Document the SAP requirements in the form of a high-level customer-specific reference model. This model provides a documentation of DoD requirements that may be shared by the government and the software vendor.

We adopted the ARIS methodology [Scheer (1999a, 1999b)] as the methodology for aligning the Army with the mySAP business suite. We selected this methodology because it aligns completely with the process-oriented structure of the SAP software, as well as with the C4ISR Architecture Framework (U.S. DoD, 1997) that is required by the U.S. DoD. In addition, the ARIS Toolset supports the ARIS methodology, which is fully object-linked for configuration control and consistency management. Additionally, the toolset allows synchronization with SAP's reference hierarchy as managed in the Accelerated SAP (ASAP) Question & Answer database (Q&Adb)[3].

Interfacing

Our approach to interfacing is pragmatic. We understand the implications of interfacing with SAP, and we understand that interfaces must be minimized in order to achieve a significant return on investment. However, we also understand the realities of having to interface with other mandated systems, such as the Standard Procurement System, financial systems, and personnel systems. SAP is a powerful solution for integrating business process domains. Its value in supporting fragmented environments is greatly diminished. The Army's long-term goal has to focus on the replacement of as many interfaced systems as possible. Since the complete elimination of interfaces is not possible, we focus on a more practical approach that blends integration with interoperability through the use of Enterprise Application Integration technologies.

Enterprise Application Integration (EAI)

Given the pragmatism of the previous section, we focus on realistic alternatives for the Army. These are the definitions that drive the discussion:

- Interfacing [i.e., Enterprise Application Integration (EAI)]: The sharing of data and business process logic across hetero/homogeneous instances through message-oriented-middleware (MOM). EAI may be managed by SAP (e.g., ALE[4]) or through solutions provided by private vendors (e.g., IBM, WebMethods, etc.) (EAI is sometimes called Application-Centric Interfacing)

- Business-to-Business (B2B) Connectivity: The passing of data (not business process logic) through agreed-upon implementation conventions of standards; e.g., EDI, XML, etc. (B2B Connectivity is sometimes called Data-Centric Interfacing).

EAI typically deals with the integration of applications and data sources within an enterprise to solve a local problem (e.g., interfacing the existing LMP solution to a legacy system is a good example). EAI typically lacks some of the features of B2B connectivity, such as community management, trading partner profile management, sophisticated security mechanisms, and support for industry standards, such as Open Buying over the

[3] We refer the reader to Brand (1999). It is assumed that the audience for this paper is familiar with this foundational material.

[4] ALE is disappearing as an EAI environment for SAP implementations, and it will be replaced with the new NetWeaver technology.

Internet (OBI), Extensible Markup Language (XML), and Electronic Data Interchange (EDI). In fact, there is often a performance issue associated with using EAI to support traditional high-volume business transactions using technologies such as EDI.

In contrast, B2B connectivity is used to pass information to external constituents such as suppliers and customers. B2B connectivity could support any number of business requirements, such as sharing information with trading partners to support a supply chain or collaborating on a product design. B2B connectivity includes many features that are absolute requirements for interacting with external claimants, but it typically does not include the deep business processes integration that is required when interfacing enterprise systems. The differences between EAI and B2B are significant, even though they both may employ middleware, such as message brokers, to exchange information among various systems. Linthicum (2001) provides a good discussion of these differences.

These are some of the distinguishing characteristics:

- B2B typically focuses on the sharing of information with external constituents, such as customers and suppliers.

- B2B typically resides outside of the integration domain, but functions in near real-time and with limited end user influence.

- B2B typically passes information using accepted industry standards, such as XML or EDI, where EAI considers the proprietary business process configurations within enterprise software products.

- B2B allows users who understand relatively little about internal business process logic to pass information across organizations, where EAI requires a detailed knowledge of the business processes as they are configured in the interfacing systems.

- B2B requires that trading partners agree on implementation conventions of industry standards. If agreement is reached, information can be easily passed.

- B2B assumes that the source and target enterprise systems cannot be altered; hence, the passing of information is “non-intrusive” in the sense that the business process logic of the interfaced systems is not affected.

- B2B requires advanced security requirements, because the organization is sharing information with external constituents.

LMP (as configured) and GCSS-A (as provide), “divide” a business process integration domain. Since SAP is comprised of integrated business processes, when these integrated processes are divided into two parts the interfacing required to make the solutions work together is complex. Hence, our recommendation is to use SAP technologies that are optimized by SAP to manage the business process interactions across the domains. Our architecture uses NetWeaver, an SAP EAI product that uses optimized messaging across SAP domains. This product is used to manage the business process interactions across the SAP domains. This proposed solution will be discussed in detail in the system architecture section of this study.

There is still a need to pass information to external constituents, such as DLA or DFAS.. Some of these transactions will be traditional B2B transactions, while others will be point-to-point legacy interfaces. NetWeaver supports these technologies as well, offering potential for a single Army interface to all external constituents. This concept is presented in Figure 3.1.

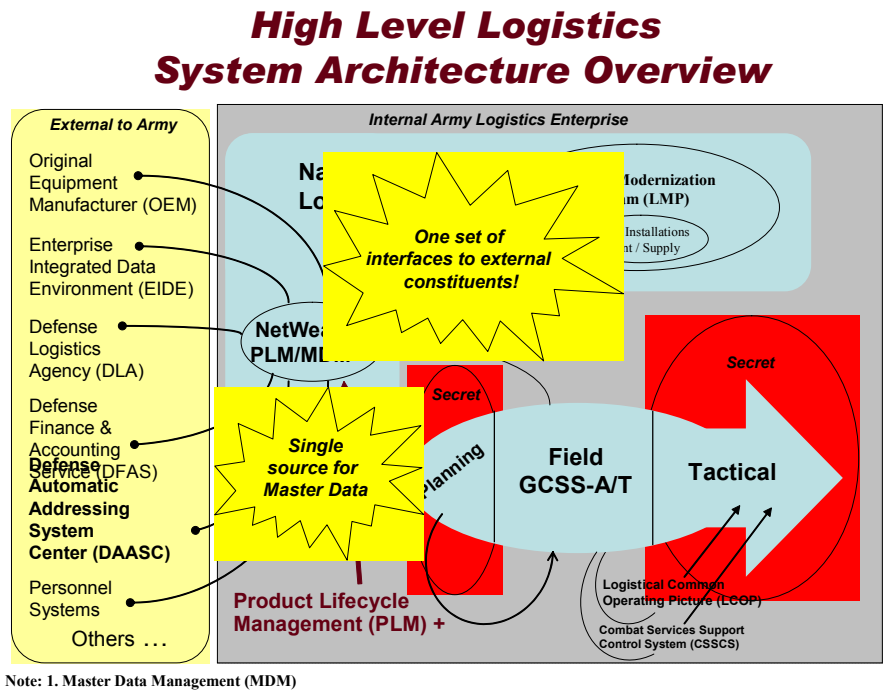


Figure 3.1 Overview with NetWeaver

This figure demonstrates how NetWeaver will provide optimized messaging across the SAP domains; i.e., national Army and field Army. It also indicates how NetWeaver could be the single Army interface for interacting with all external constituents. The benefits of such an architecture are obvious. For each external mandated system, the Army only has to maintain a single interface at the NetWeaver hub. This eliminates many point-to-point interfaces and creates a single Army point for negotiating all external interfaces. In effect, the NetWeaver hub becomes the focal point for doing business with the Army. Since the NewWeaver hub can be configured as separate SAP solution (with its own IMG), we recommend that this hub be designed and maintained at the national level by the DAEI.

SAP NetWeaver is comprised of the following:

- Multichannel access -- Web and mobile access to business systems in connected and disconnected scenarios,
- Enterprise portal - internal and external unified user interfaces through a Web browser in role-based fashion,
- Collaboration - real-time and asynchronous communication between people, in either a moderated or free-form fashion,
- Business intelligence -- the infrastructure for extracting, aggregating and analyzing structured business information across the enterprise,

- Knowledge management -- unifies multiple sources of unstructured information, such as document management, file services, XML feeds, and so on for providing and managing knowledge,
- Integration broker - for internal and external process integration, based on XML messaging
- EAI-level business process management - design, development, execution, monitoring, and management of business processes across the extended enterprise,
- J2EE/ABAP - provisioning of native, highly secured Web services implemented and developed in JAVA or ABAP and extensibility through Microsoft .NET and IBM WebSphere,
- Database and operating system independence -- open and operable on all relevant platforms, and
- Life-cycle management -- development, composing and modeling, testing, deployment, and management of the entire software landscape.

Master Data Collaboration

Our recommendation is a single set of master data for the Army. In today's environment, it is not practical to assume that a single set of master data could be maintained in a single location. Hence, our recommendation is that strict master data controls be instituted at the NetWeaver hub. NetWeaver includes master data management (MDM) services. MDM was designed to solve the widespread challenges of data integration from multiple systems, physical locations, and diverse vendors. MDM ensures information integrity across the business network by allowing organizations to consolidate, harmonize and centrally manage master data in heterogeneous environments.

Product Lifecycle Management

Private sector companies often have product managers. They manage the product lifecycle from "cradle to grave." This includes R&D, engineering, production planning & control, manufacturing, distribution, maintenance, support, and return & disposal. All of the major ERP vendors support this ***Value Chain*** concept using an integrated approach called Product Lifecycle Management (PLM).

PLM is a concept that brings together in one shared environment everyone involved in product development, manufacturing, and customer service. PLM takes into account that for most products, development is influenced by feedback from the marketing and field-support segments of the product lifecycle. PLM interprets this extended value chain of influencers as one business process, as opposed to a series of separate silo-based business processes. Hence, all value chain participants need direct access to product-related information. From a DoD perspective, instantaneous access to all relevant data to support a particular business process is the definition of the integrated knowledge environment. The value chain view of PLM is presented in Figure 3.2, and a functional view is presented in Figure 3.3.

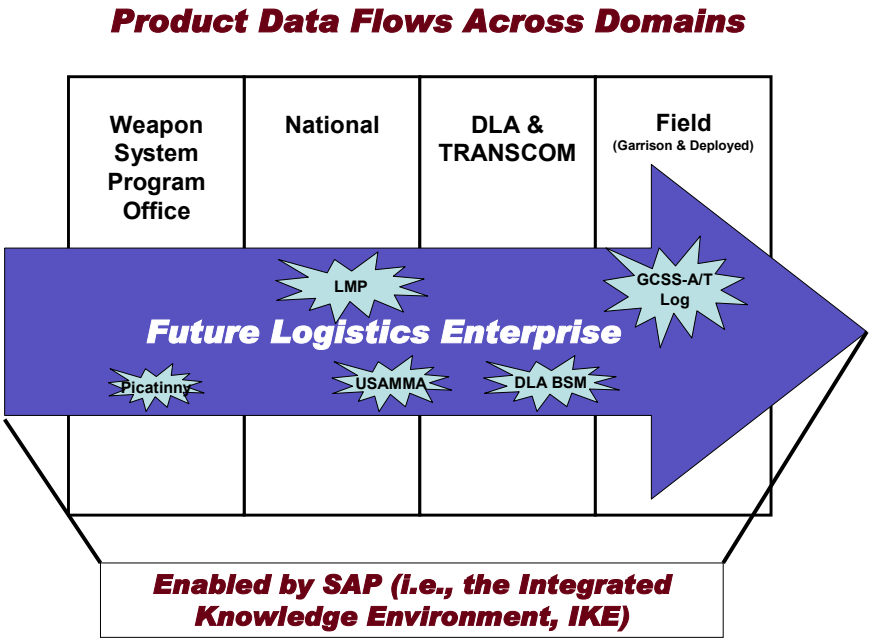


Figure 3.2: The PLM Value Chain

The SAP functional view is a static representation of a complete PLM solution as defined by SAP's customers through its user support groups[5]. The value chain view, which plays a critical role in the Army's Logistics Enterprise architecture, will be explained in more detail in a later section, but for now, it is important to note that PLM spans across the logistics enterprise and its extensions.

From an implementation point of view, PLM has the greatest penetration in the automotive and high tech industry sectors, with aerospace and defense being third. These industries are characterized by large numbers of complex product structures that must be managed across multiple views of product data. Given the nature and complexity of weapon system product data, the Army is an organizational "fit" for implementing PLM functionality. General industry PLM metrics are presented in Internet World (2003).

As a case study vignette, a representation of the PLM concept as employed by Pratt & Whitney is presented in Figure 3.4. The figure indicates that product data is created during the engineering/design phase of the product lifecycle. This "as-designed" product data flows into the manufacturing process, where it eventually is extended into an "as-manufactured" view of the same product data. During the maintenance phase, the same product data is extended into an "as-maintained" view that supports asset tracking, maintenance history, and performance data.

[5] The complete Product Lifecycle Management solution map may be downloaded from the following URL: http://www.sap.com/businessmaps/pdf/Product_Life_Cycle_Management_Solution_Map.pdf/.

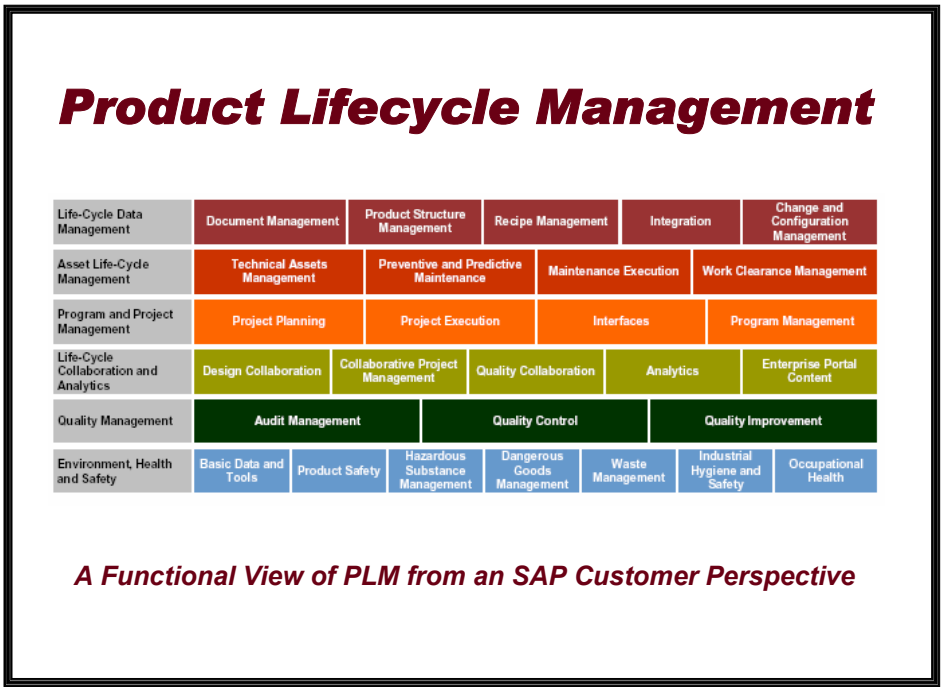


Figure 3.3: An SAP Customer View of PLM Functionality

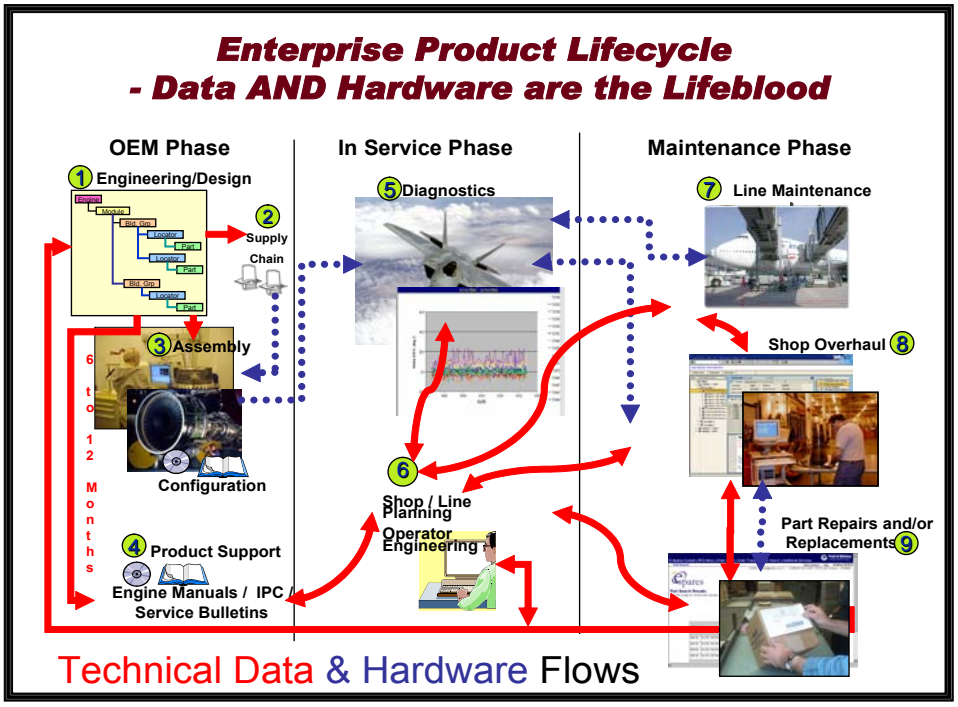


Figure 3.4: Technical Data Flows at Pratt & Whitney[6]

[6] Figure used with the permission of Mr. Peter Longo, CIO of Pratt & Whitney.

At the end of the maintenance phase, diagnostic and prognostic data can be captured at the platform level and "fed back" to the appropriate levels in the value chain for analyzing and responding to prognostic and diagnostic signals. Of course, the PLM repository is the single source of all technical data, including product support, manuals, service bulletins, sustainment, etc.

The DoD equivalent to PLM is Total Lifecycle Systems Management (U.S. Department of Defense, 2002), a major component of the Future Logistics Enterprise. The program manager (i.e., the DoD equivalent of the product manager) is responsible for managing the complete weapon system lifecycle, which includes concept development, R&D, acquisition, testing, initial fielding, sustainment (including maintenance), in-service support, and disposal.

Since the commercial and DoD solutions are similar, the Army end-to-end value chain can be aligned with the commercial ERP software solutions. The Army has already made the decision to align its value chain with the SAP software solution, and SAP provides a full solution for PLM. The Army SAP solution must be extended to include PLM, since PLM is the integrating thread that pulls all value chain participants into the same integration domain. There are known Army gaps, and existing and proposed projects must be realigned, but without such realignment, the Army's investment in SAP will not achieve the desired ROI. This report defines a path to the desired end state. Of course, the hard work of realigning boundaries, plans, and business cases will have to be completed over the coming months, and this tasking should be completed as soon as possible.

Product Data Management

Product Data Management (PDM) is a combination of change and distributed electronic document management to support product development in manufacturing. PDM emphasizes the managing of formal product structures; therefore, the concept favors discrete manufacturing. PDM is a subset of PLM, with the following capabilities:

- Configuration management,
- Data control and vaults,
- Archiving,
- Access control and security,
- Release and approval,
- View and markup, and
- Engineering change management.

PDM favors the front end of the Product Lifecycle Management process, where engineering data is created. In fact, PDM is a critical business process to support design engineers at the weapon system manufacturer. PDM is also a critical component at the weapon system program office, since government personnel must collaborate with commercial design engineers. The main point is that the weapon system manufacturer and the weapon system program office are the critical data creators in the PDM process. Over the total PLM process, which includes PDM, most value chain participants are technical data viewers, not requiring much of the functionality of commercial PDM solutions.

AMC has a vision for product data management, as defined by its proposed ePDM initiative: [provide a] "seamless flow of the right product data, where required and when required, rapidly, accurately and reliably among authorized engineering, procurement, program management, logistics communities and defense contractors users, as appropriate." We agree with this vision, and it relates to the central thread in the architecture.

The architecture demonstrates how technical data is the end-to-end thread that flows through the Total Lifecycle Systems Management value chain; hence, PLM and its subset PDM must be designed with the Army's ERP solution.

Asset Tracking

Asset accounting is required by law (i.e. CFO Act), and it is needed for reports on readiness conditions. At a minimum, location, condition, and financial data are required. These assets are defined in SAP through the equipment master for major end items, and through the material master for inventory items. These masters must be self-contained inside the integration domain. Once these data masters are secured inside of SAP, it is possible to carry other critical information with the asset for instantaneous reporting and monitoring; e.g., maintenance history, performance data, quality data, etc.

The Standard Property Book System – Redesign (SPBS-R) is the entry point into the standard property accounting system for the Army. This system is maintained at the division level by the Division Material Management Center (DMMC). The system was developed and implemented to satisfy the following objectives:

- Standardize automated property accountability procedures Army-wide,
- Eliminate the need to retrain personnel moving from one property book to another,
- Provide a user-friendly system which requires minimal specialized computer training, and
- Enhance supply responsiveness through automated interfaces with other supply and asset reporting systems.

The information from SPBS-R is passed to a number of systems, including the Continuing Balance System – Extended (CBS-X). In a typical scenario, when a requisition for an asset item is issued on the battalion level, the requisition is passed up to the division level where it is processed in the SAARS-1 and in SAARS-2AD before passing it up to the SARSS-2AC/B on the Corps level. Depending on the availability of the required asset, it might then be passed over to the Material Management at the national level (at this level the requisition leaves the Domain of the GCSS-A).

At this level, an input to verify and legitimate the requisition is checked in the CBS-X. The CBS-X provides the official unit level worldwide asset position for major items. It is a system for field reporting and centralized recording of adjustments in asset position. The CBS-X maintains worldwide visibility of reportable items to the UIC level by Line Item

Number (LIN) and National Stock Number (NSN). This, in our opinion, is the source of the equipment master in SAP.

After the verification, a material release order is issued to a depot that processes this requirement in its standard system. The item and its data are then shipped to the Division.

By issuing the item to the user, the item data are manually maintained in the SAMS-1. Additionally, CTIL (Commanders Tracked Item List) data is sent to the Command and Control system, which is a classified system.

From this scenario, it becomes clear how many systems are involved in the fulfillment of an asset requirement. The SPBS-R interfaces with a number of systems at different levels of the Army, including

- Standard Army Retail Supply System – Objective (SARSS-O),
- Standard Army Maintenance System (SAMS),
- Unit Level Logistics System – S4 (ULLS-S4),
- Standard Finance System (STANFINS),
- Standard Army Ammunition Systems (SAAS),
- Combat Service Support Control System (CSSCS),
- Continuous Balance System – Extended (CBS-X),
- Logistics The Army Authorization Tracking System (LOGTAADS),
- Unique Item Tracking (UIT), and
- Total Asset Visibility (TAV).

Our architecture indicates that, from a business process perspective, these systems should be considered as candidates for replacement by SAP. In some cases this confirms what was already known, and in other cases, retirement issues will be complicated by external concerns. There may be other reasons for not considering some of these systems [e.g., ownership (STANFINS) or security (CSSCS)], but from a functionality point of view, SAP has proposed solutions in the current or future product offerings.

Chapter 4

Army Logistics Architecture

Addressing the Transitioning Army

The Army is transitioning as transformation efforts continue. Hence, the Army Logistics Enterprise Architecture must consider three parallel evolving organizations: The Army of Excellence, the Interim Force, and the Objective Force.

The Army of Excellence

The Army of Excellence represents a continuous improvement of the legacy force. "Efforts involving the legacy force focus on improving the major weapon systems the Army currently has in its inventory, principally ground combat vehicles such as the Abrams tank, the Bradley Fighting Vehicle, armored fire support and combat support vehicles." The Army of Excellence will be "continually upgraded with product improvements to existing equipment." This force will continue to be the Army's primary maneuver force for the near future.

Interim Force

The Interim Force is an enhanced force for today with some characteristics of a "leap ahead" organization. The Army's plan is "to use available technology to reequip brigade-size units (Interim Brigade Combat Teams) to adapt them to meet many of the Army's missions. This will enable them to deploy more quickly than the heavy forces, but with more combat power, ground mobility, and protection than the Army's light forces (airborne, air assault, and light infantry units)."

Objective Force

The Objective Force combines the best aspects of the Army of Excellence and the Interim Force. "It will be equipped with the Future Combat System, a 'system of systems' with four primary functions: direct fire, indirect fire, battlefield transport of infantry and sensing. Technological advances that allow the FCS to be far lighter – and therefore much more deployable, mobile, and agile – include the development of electromagnetic propellant systems for projectiles, directed-energy weapons, precision missiles, networked fire control, ceramic armor, reflective armor, advanced electric propulsion systems, fuel cells, and robotics." These technological advances are a key factor in allowing the Objective Force to retain the capability for victory on the battlefield and success in other operations across the full spectrum of missions."

The Army Logistics Enterprise

We have examined the Army logistics enterprise from two levels:

- The National Army level, and
- The Field Army level.

We selected these levels for two reasons. First, we wanted to avoid all discussions about artificial restrictions; i.e., wholesale and retail. Second, we wanted to avoid doctrinal levels (i.e., strategic, operational, and tactical), since these levels are not firm for logistics. That is, strategic resources are occasionally sent deep into theater. Also, by using the Field Army terminology, we reinforce that deployed and garrison forces are using the same solution. We follow the OSD guidance in defining the Army Logistics Enterprise so that it will align with the Future Logistics Enterprise. This means that the baseline architecture is built around a Total Life Cycle Systems Management paradigm.

The Army Logistics Enterprise Architecture

The details of the architecture are presented in Chapter 8, but as noted above, we follow the OSD paradigm that is presented in Figure 4.1.

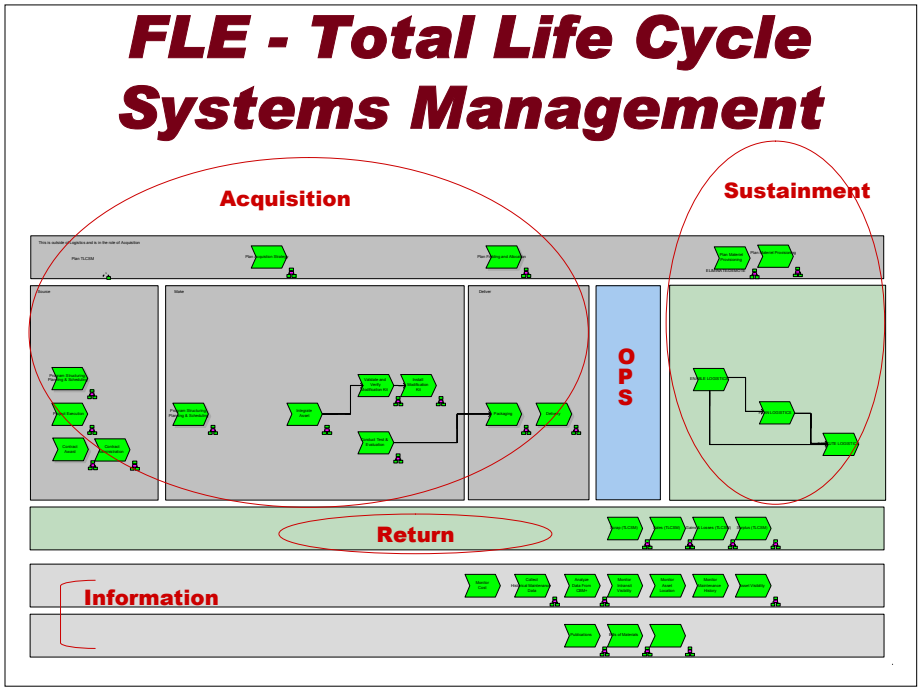


Figure 4.1: OSD FLE TLCSM Architectural Paradigm

The Army version of this value chain is presented in Figure 8.8, and the details are described in Chapter 8.

The Architectural Framework

Our statement of work requires that we follow the C4ISR Architectural Framework[7] (U.S. Department of Defense, 1997). Specifically, we are required to produce a subset of the operational and systems views (OV-1, OV-2, OV-5, OV-6a,c, and SV-1). These views are presented in Chapter 8, and they will be delivered in repository form at the end of the project.

Operational Value Chain Architecture

The Army operational value chain architecture is aligned with the Army logistics enterprise, resulting in two value chains: the national Army value chain and the Field Army value chain. These are depicted in Figure 8.2 and 8.3, and in more detail in other figures in Chapter 8, and in significant detail for those areas where specific architectural questions are proposed. The field Army value chain is not separated into garrison and deployed value chains. This is intentional, since the single field Army value chain applies to both.

System Architecture Overview

The highest level system view is presented in Figure 3.1, and is discussed in some detail in Chapter 6. We did a careful study of the as-is systems as they were mapped to to-be business process objects for SAP. We also included the input/output data flows from the various systems, so it provides a powerful vehicle for analyzing the system landscape. There is no equivalent C4ISR view, but we needed this view to analyze the Army system landscape. The picture is presented in Figure 4.2.

[7] See Appendix B.

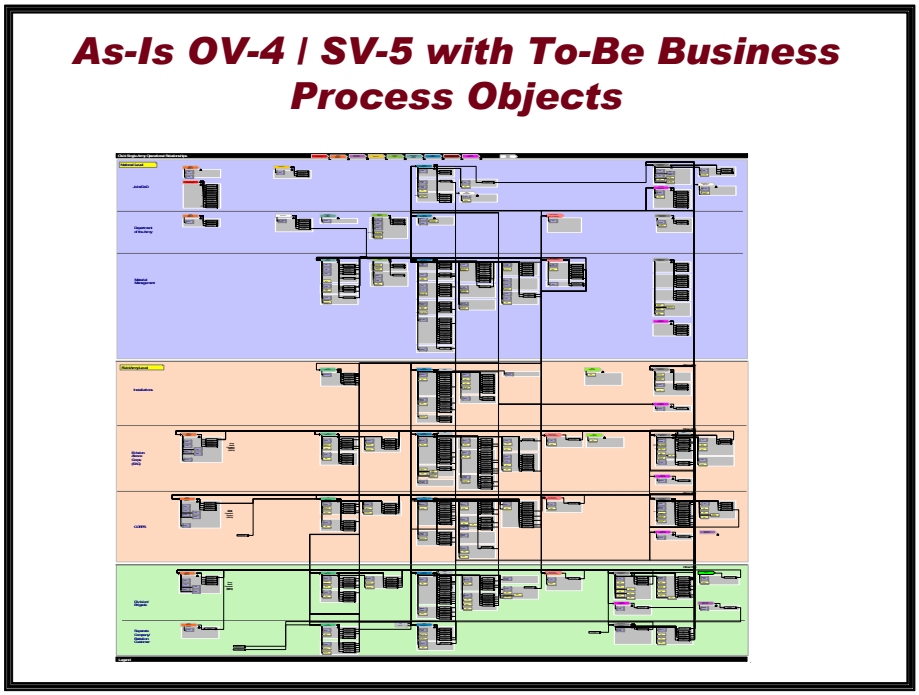


Figure 4.2: As-Is SV-1 with To-Be Business Process Objects

To refine this picture and align it with the business processes, we constructed a combined SV-1 and SV-3, and then mapped it to the business processes. This view is summarized in Figure 4.3.

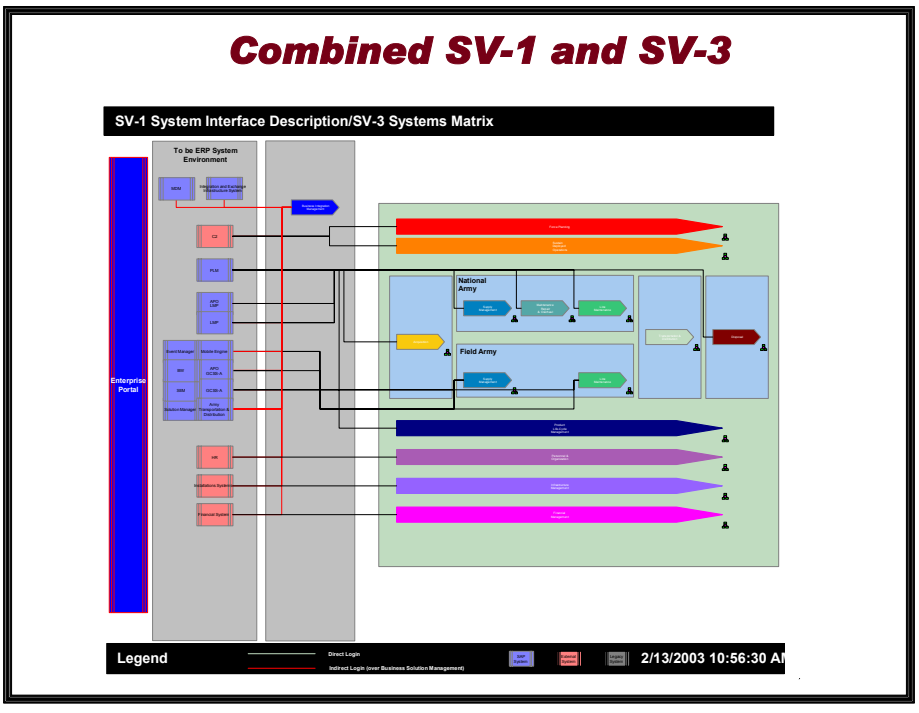


Figure 4.3: SV-1 and SV-3 Mapped to Business Processes

We analyzed the details that are summarized in Figures 4.2 and 4.3 to derive the architecture that is summarized in Figure 3.1. We used our knowledge of existing and emerging commercial software solutions to help us evaluate alternative architectural configurations. Our challenge was to address work through the technical details behind Figure 3.1. For example, we have many issues that we are addressing:

- How robust is the architecture?
- What is the scalability of the architecture?
- How flexible is the architecture?
- What are the infrastructure requirements to support the architecture?
- Etc.

These details will be included in Chapter 6 of the final deliverable.

Chapter

5 High-Level Cost and Benefit Data

This section contains an independent assessment by the Gartner Group on Best Practices in ERP deployment and the associated cost/benefit data that is important for integrating the single Army logistics enterprise.

Logistics ERP Cost/ Benefit and Best Practices

In January 2003, MIT Sloan Center for Information Systems Research (CISR) worked with Gartner's Executive Programs (EXP) on a major research project involving more than 250 CIOs. This first hand, real world research concluded that IT governance performance correlated positively and significantly with several different three-year average measures of financial performance for for-profit enterprises:

- Return on Assets (ROA) – deriving value from your investments in assets.
- Return on Equity (ROE) – deriving value from your shareholder investments.
- Growth in Market Capitalization – deriving value from your market growth.

Additional Gartner research this year predicts that by 2006, enterprises with the best practice post go-live support model for their SAP life cycle management will obtain 10 percent lower Total Cost of Ownership (TCO) than those that don't (0.7 probability). To achieve optimal post go-live support for such integrated business applications a "jig saw puzzle" is required within the enterprise which interlocks the following 5 elements:

- Business Management Ownership
- Business Super-users
- IT Help Desk
- IT Infrastructure
- SAP Competence Center

The inter-relationship between these key elements is graphically depicted in Figure 5.1 below, for a fully insourced scenario.

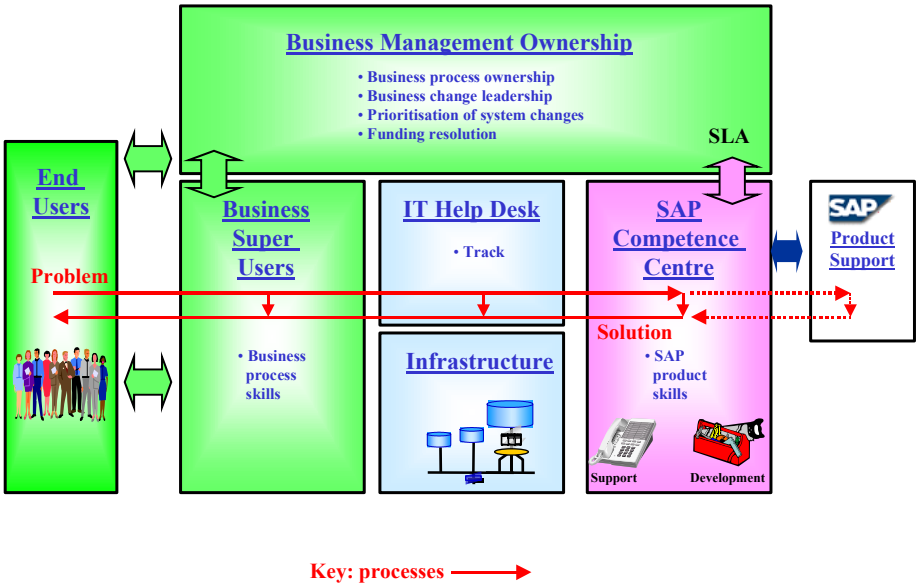


Figure 5.1: The Model For Optimal Post Go-Live Support Of SAP Applications

The next several sections show current trends in governing and deploying a Logistics ERP in terms of cost/ benefit and commercial best practices. The next few paragraphs highlight the topics of these sections. These Gartner research topics are of interest to any enterprise implementing an ERP system within an enterprise-wide architecture.

In the first section, "Organizational Issues in Building ERP Architecture," Gartner presents three organizational critical success factors that consistently make or break an ERP architecture initiative:

- The Right Governance Model
- Organizational Change Management
- The Architecture Team Structure

The section on "Key Issues To Consider When Planning The Structure Of An R/3 Implementation" discusses a critical decision around how to structure the implementation in terms of centralization vs. decentralization of the technical architecture.

In "Total Cost Of Ownership (TCO) For Centralized Vs. Decentralized ERP", Gartner discusses centralized (lower TCO) deployment vs. decentralized (higher TCO) deployment. It is important to understand when reading this section, that Gartner is not recommending a single instance of the ERP to achieve the best TCO. Rather, Gartner recommends standardizing with a single vendor using smart consolidation (i.e., "controlled redundancy") for efficiency and optimization to best suit the Army's goals and requirements.

Most successful organizations implement a Central Competency Center (CCC). In the section “ERP CCC”, Gartner discusses the merits behind this service center.

As part of an overall logistics enterprise architecture, it is important to know “Who Owns The Logistics Business Processes”. Gartner describes the merits of implementing a Business Process Team that should improve the Army ‘s management of their end-to-end logistics process. The Army will find this increasingly required, as its processes become more complex and interdependent.

Next, Gartner presents its research in “How To Implement A Successful ERP”. These sections cover commercial best practices as ERP migrates to ERP II and collaborative business processes.

Finally, Gartner presents a case study in “Case Study – How Procter & Gamble Runs its Global Business on SAP” to shed further insight for the Army in integrating their supply chain.

After presenting the Gartner research, the final section will summarize the “take away” points that are of primary interest to the Army as they undertake the task of building the next generation, “One Army” logistics enterprise system.

Organizational Issues in Building ERP Architecture

For many enterprises, execution is the most difficult stage of an ERP architecture program because it requires changes in ingrained behavior at every level of the organization, within and beyond the IS organization.

Common organizational issues repeatedly derail enterprise ERP architecture initiatives. By implementing a three-tiered governance structure, developing organizational change management techniques and involving the right people in the architectural process at the outset, enterprises can greatly improve the success of their ERP architecture programs and their ease of transition.

Realizing the benefits of an enterprise ERP architecture means going beyond matters of technical design to achieve successful execution and compliance. For many enterprises, this is the most difficult aspect of ERP architecture, because it requires changing ingrained behavior at every level of the business. The organizational issues of executing an enterprise ERP architecture are rooted in 30 years of legacy practices and attitudes, which held that:

- Stakeholders were best served when operational units were allowed maximum autonomy
- ERP's predominant value was in reducing costs
- IS was a cost center and, therefore, overhead
- The optimal IS skill profile was strictly technical

Today, these norms are counterproductive because they perpetuate non-cooperation across organizations and between business and IS leaders. Globalization and virtualization require an ERP foundation that enables shared processes and information across organizational, technical and geographic boundaries. Modern business strategies such as customer relationship management, supply chain management, e-business, knowledge management, the "agile workplace" and virtual collaboration require an

enterprise-level design approach to ERP. Unfortunately, habitual legacy management behaviors undermine these new imperatives. Only an enterprise with the discipline to address outdated practices will build a successful architecture and the core business strategies that depend on it. **Three organizational critical success factors consistently make or break an architecture initiative.**

Critical Success Factor No. 1: The Right Governance Model

For enterprises characterized by autonomous business units, governance is an area where there is one correct answer. Not unlike the U.S. system of government, with its executive, legislative and judicial branches, the enterprise governance structure is three-tiered. Like the federal government, take one branch away and the entire mechanism will collapse. The three ERP governance tiers are the strategic branch, the operational branch and the technical branch. The executive branch is comprised of the enterprise's chief officers. Its role is to articulate business objectives in an actionable way and to enforce the enterprise ERP architecture. The operational branch is essentially a permanent steering committee with portfolio management responsibilities. It is comprised of senior organizational leaders and the CIO. Its role is to establish the portfolio of projects that are most likely to support business strategy, to determine how ERP resources will be allocated across those projects, to ensure projects comply with their stated business case and to reconcile competing demands for IS resources. The technical branch is comprised of the CIO, the enterprise architecture team and the team's advisors. Its purpose is to design and maintain a robust ERP architecture that explicitly enables business strategy.

Without this structure, the chief officers usually delegate their responsibilities to the organizational leaders, who are focused on their individual agendas, rather than on those of the entire enterprise. Although they may fulfill their governance function for enterprise-level projects, they often fail to consult on projects that they consider specific to their organizations. The effects of this include:

- The organizations develop disjointed strategies that may conflict or cause redundant efforts (e.g., seen today with the Army's acquisition, sustainment, and field organizations).
- Because the IS organization has no accurate frame of reference for making architectural decisions, its recommendations lack justification. It is forced to be reactive, which inhibits the business, or it must make its best guess, which will often be wrong.
- When organizational projects are accounted for, the total demand for new ERP capability exceeds resource availability. Because IS personnel are the bottleneck, the IS organization effectively establishes what business projects get done.
- The IS organization is forced to decline projects. Business units seek outside assistance, which further exacerbates interorganizational distrust and increases the complexity, cost, inflexibility and unreliability of the environment overall.
- The CIO is outnumbered by organization leaders with interest in maintaining their autonomy, and has little ability to influence architectural compliance or cooperation across organizations.

As result of these behaviors, the architecture is never implemented. The advantage of the three-tiered structure is that it places accountability for business decisions with the business and for technical decisions with the IS organization — where they belong. By involving the chief officers, the three-tiered governance structure creates checks and balances to ensure that the IS organization doesn't become academic and that the business complies with a cohesive architecture, unless it has a good reason not to.

Critical Success Factor No. 2: Organizational Change Management

Making the transition to an ERP architectural approach requires the development of organizational change management competencies throughout the enterprise. Three constituent groups must buy into the ERP architecture if it's to succeed.

Senior Leadership: Senior leaders must be educated to understand the strategic, enabling role of ERP — not just its operational contribution or capacity for cost reduction. They must overcome their fear of ERP and embrace their governance roles to become as comfortable with ERP-related business decisions as they are with financial ones. Senior leaders also must balance organizational autonomy with enterprise-level imperatives.

Organizational Middle Management: Middle management often fails to understand the enterprise architecture paradox — that to free themselves they must submit to certain ERP guidelines. Middle managers' perspectives are narrower than those of enterprise-level management. They often view ERP architecture as a collection of rigid standards that, at best, impedes their ability to meet their objectives by constraining their flexibility or, at worst, threatens their autonomy. In the early stages of ERP architecture, when the enterprise is building critical mass in new skills and in the architecturally compliant installed base, the costs and timelines of individual projects may increase compared to traditional approaches. This must be recognized and dealt with appropriately. Otherwise, middle management will resist all compliance efforts.

Technical ERP Staff: To the extent that ERP staff have been hired exclusively for technical skills, they will tend to identify personally with specific technologies and platforms. ERP Architecture entails the consolidation of redundant processes and technologies into a smaller set of standards and practices, leading to the potential elimination of cherished platforms and work methods. Many staff will be frightened by the prospect of being replaced, shouldered onto a "slow" track or forced to learn fundamentally new skills. If the enterprise has a history of under-funding training and expecting technical resources to "sink or swim" when adjusting to new technologies, this problem will be exacerbated. As a result, staff can become contentious in insisting that their platforms become the standard. They can also perpetuate the use of undesirable technologies through outright insubordination or resort to malicious compliance.

These constituent groups have legitimate reasons for perceiving ERP architecture as a threat and, therefore, for resisting an ERP architectural initiative. Organizational change management practices of education, communication and stakeholder engagement, along with the judicious use of behavioral change levers, will forestall or mitigate many of their dysfunctional behaviors.

Critical Success Factor No. 3: The Architecture Team Structure

A robust ERP architecture can only be designed by individuals with the creativity to understand the application of technology to specific business opportunities or problems, and with the technical sophistication to understand the potential uses of new and existing

ERP components. It is critical to have the right core team leading the ERP architecture development project. ERP architecture is also a full-time job. An enterprise architect may be involved in discovering business strategies and objectives, developing theoretical domain architectures, conducting proof of concepts, evaluating product alternatives, prototyping new technologies, advising or participating on projects, providing advice on requests for exceptions or changes to the approved architecture, engaging or training technical staff, and continually monitoring emerging technologies. It is unreasonable to assume that one individual can serve as the sole enterprise ERP architect, or that current personnel can absorb all ERP architecture responsibilities. It is also unwise to assume that all leverageable technical expertise resides in a single IS organization, or that all business expertise resides outside of it. A cascading structure that draws on technical and business process personnel is optimal.

- The core architecture team is comprised of full-time architects — typically at least one for each ERP architectural domain (examples include data, application, integration, services and telecommunications domains). These individuals are the final arbiters of architectural standards, methods and practices within their domains.
- The second group is a permanent advisory group. This group, which includes technical and business personnel, usually draws on the top 20 percent of technical performers in the enterprise. Business unit representation might come from core process owners, ERP-savvy power users, or technical experts from engineering, R&D or distributed IS organizations. This group's workload is adjusted, enabling it to devote approximately 30 percent of its time to architecture endeavors. Its role is critical to preventing myopia on the part of the core team and to building grass-roots buy-in for the architecture in its members' home departments.
- The third group is a pre-identified advance team, made up of business and technical staff with the willingness and ability to adapt to new practices and technologies.

Bottom Line

There are three organizational critical success factors that consistently make or break an ERP initiative:

- The Right Governance Model
- Organizational Change Management
- The Architecture Team Structure.

Key Issues to Consider When Planning the Structure of an R/3 implementation

For large R/3 implementations, one of the most-critical decisions is how to structure the implementation in terms of the number of R/3 clients and their locations (see Note[8]). The question of whether to centralize with a single production client or to design several clients at a country or business unit level is frequently asked. Another critical decision is how to structure the server infrastructure in terms of the number of R/3 production systems and their locations. When speaking to clients on this topic, Gartner has found confusion over technical issues and especially the terminology.

The structure of the implementation is a high-risk decision, and each contributing factor should be explored. The final decision will depend on a combination of cultural, application, technical and cost-related issues. In this section, Gartner introduces the cultural, application and cost issues.

The overwhelming majority of R/3 implementations are centralized, and this is where the highest degree of experience and expertise can be found. However, R/3 does support a decentralized approach. Large companies with multiple business units and large user communities are the most likely to consider a decentralized environment. Company culture usually emerges as the determining factor for selecting the optimal approach for any new R/3 project (see Figure 5.2).

	Centralized	Decentralized
Culture	Centralized command and control Business is stable	Business Units (BUs) are autonomous Business is dynamic
Application	Standard business processes across all BUs Standard analytical requirements across all BUs One set of master data is possible	Unique business processes at the BU level Unique analytical requirements across all BUs More than one version of master data is required
Cost Issues	Life cycle costs are lower	Life cycle costs are higher

Figure 5.2: R/3 Structure/Decision Factors (Source: GartnerGroup)

[8] R/3 Client In the R/3 environment, the word "client" has two meanings: The first and most-straightforward refers to the desktop environment. The second is more complex and refers to the highest level in the SAP hierarchy. This level can be a business unit, an individual company, a holding company or corporate view in a multi-business environment. The client can represent a global, regional or local business. It is possible to model several businesses within a single client. The client contains the customizing data, and its design is a major decision as it defines the granularity in which the business is modeled within R/3. From a technical perspective, a client represents a separate unit on the database. In most cases, a user is logged into one client at a time; however, it is technically possible to configure the system to allow a user to access more than one client.

Culture

The impact of enterprise culture on the decision is not strictly R/3-specific. Issues such as business unit autonomy and/or a dynamic, rapidly changing, business environment could push the business toward a more-decentralized approach. The culture of many organizations positively encourages central control of the business and the IS organization. On the other hand, many organizations endorse a more hands-off, autonomous approach to managing their business units. In such an environment, IS departments prefer a more-decentralized systems philosophy.

Application

Functional constraints specific to R/3 and the R/3 hierarchy will influence the decision to use a centralized or decentralized implementation. The nature of the application and certain "invasive" parameters will constrain business unit autonomy and flexibility. A centralized implementation implies a high degree of standardization in business process, data definition and analytical requirements. When the configuration must represent the unique requirements of all business units, a decentralized approach is best. Another key factor is the amount of change in the business environment. If a large multi-business-unit enterprise needs to react to changes in the business environment — such as a reorganization, product line changes, a merger or a divestiture — it may be difficult to change the configuration to react quickly enough. A decentralized approach in which interrelationships are minimized would allow a quicker response to such events.

Technical Architecture

SAP defines its overall technical architecture as the Business Framework, which integrates the R/3 Business Components, e.g., Finance/Logistics, Human Resources and Business Warehouse; Web servers; and legacy systems. R/3's three-tier client/server model is used for any production system; it features multiple servers. One or more Business Components may be run on a single system; however, they are separately upgradeable only when run on separate production systems.

Distributed Systems Terminology: The basic issue is whether to have a single, centralized production system or more than one decentralized system for a particular Business Component. For the discussion below, we define terms in a SAP-specific context:

R/3 Client: In the R/3 environment, "client" has two meanings: The most-straightforward refers to the client desktop layer. The second meaning is more complex and refers to the highest level in the SAP data model. This can be a business unit, an individual company, a holding company or a corporate view in a multibusiness environment. The client can represent a global, regional or local business. It is possible to model several businesses within a single client. The client contains the customizing data, and its design is a major decision, since it defines the granularity with which the business is modeled in R/3. From a technical perspective, a client represents a separate unit within the database. In most cases, a user is logged into one client at a time; however, it is possible to configure the system to allow a user to access more than one client.

Centralized: A production system has one set of master data, and one database, which can contain multiple clients. We define a centralized system as a Single Production Client, i.e., one global view of an enterprise's business data. The term "instance" is ambiguous and should be avoided in this context.

Autonomous Decentralized Systems: It may be possible to subdivide the enterprise's processes and business data into a number of totally separate, geographically distributed production systems. In this environment, the production systems do not communicate.

Interlinked Decentralized Systems: This environment is decentralized; however, communication exists across production systems to integrate business processes/data. The Business Framework uses auto linking and embedding (ALE) messaging to loosely couple the systems. Several predefined ALE distribution scenarios provide business synchronization between co-operating R/3 systems. The technology is effective, but the setup is complex, requiring intensive systems management.

Technical Design Issues: Technically, both the centralized and decentralized approaches are possible. As part of the decision-making process, it is necessary to review the business issues, as well as a number of technical design issues, as follows:

- Data Issues: A centralized approach avoids potential data replication/synchronization issues, but requires management and protection of a much-larger database. Pay attention to disk storage subsystem design in either approach. Some spoken languages may need to run on separate systems.
- Server Size: Centralized systems require larger production system servers. Online data entry time windows will be extended by time zone differences. R/3 batch processing requirements are frequently overlooked in early sizing analyses. With either approach, focus the analysis on the heavier logistics modules and response times.
- Server Scalability: The largest centralized R/3 systems are currently about 2,000 concurrent users, with a 750-Gbyte database. Enterprises with production systems larger than these current guidelines should consider decentralized systems.
- System Availability: Regardless of the approach, large projects have high expectations (e.g., 7x24 operation) for overall system availability. This requires meticulous cluster design, disaster recovery strategies and operating processes.
- Network Design: Interlinked decentralized systems require heavier communications traffic. Build in the right level of network bandwidth, latency and redundancy with either approach. Varying costs of international communications can affect the choice of location of the enterprise's data centers. In some places, it can be hard to provide network connections to remote users that have acceptable end-to-end response time/reliability.
- Systems Administration: Centralized systems require fewer overall Basis experts, but have more critical resources to retain (unless infrastructure is outsourced). Centralized systems need fewer upgrades; however the databases are harder to back up and recover. Large projects require extra NSM tools for end-to-end management.
- Infrastructure Costs: Enterprises should budget for hardware, tools, system support, network infrastructure, systems administration, upgrades, disaster recovery and skills retention. Infrastructure costs are usually lower for the centralized model.

Cost Impact

Managing a decentralized R/3 environment can be expensive and complex. Despite SAP's progress with its middleware (ALE), relatively few sites have it implemented. In general, R/3 application and technical skills are scarce and at a premium in the ERP labor market. R/3 also requires a significant investment in a supporting infrastructure from both a hardware and software perspective. Generally speaking, leveraging the investment in infrastructure and skills across many business units and centralizing the application will lead to a lower cost of ownership from a life cycle perspective. Enterprises that are considering a decentralized approach should factor in the cost issues well beyond just the implementation as these costs will be affected by the structure. Business units that are proposing a decentralized solution should be asked to justify the additional expenditure and demonstrate perceived benefits. Regardless of the structure selected, business units should understand how R/3 costs will be allocated to them. Those that opt for a decentralized approach should plan for a higher total cost of ownership.

Bottom Line

There is no one right way to structure a large R/3 implementation. Cultural factors, application design issues and cost are major factors in the overall choice between a centralized or a decentralized approach to R/3. Enterprises should examine closely the culture and pace of change within the business as input into the decision-making process. After this is done, the technical and cost-related issues also need to be examined. There is a wide variation in the distributed systems terminology used by the SAP ecosystem. Enterprises need a clear understanding of this terminology to avoid ambiguity and facilitate discussions that will take place during the decision process. The final decision should be based on a combination of all of these inputs.

Total Cost of Ownership for Centralized vs. Decentralized ERP

Comparing the total cost of ownership (TCO) of centralized vs. decentralized ERP is an important first step in understanding the value of a "One Army" logistics architecture. Enterprises should consider centralized ERP deployments to reduce the TCO of multiple disparate applications. This does not intend to imply a single instance of an ERP solution, rather a consolidated enterprise-wide architecture within which Army solutions will fit. The recommended goal of "controlled redundancy" assures that consolidation supports the end-to-end Army logistics business process from both a National Army and Field Army perspective. The next several paragraphs represent Gartner research on why a more centralized approach is better than a totally decentralized approach – further supporting the Army's strategic direction.

Multi-site architecture strategies and deployment plans are becoming increasingly critical for enterprises supporting ERP systems on different platforms, databases, data structures, storage systems and continents. When building the business case for centralizing these systems, the most frequently asked question is: Which has a higher TCO, centralized or decentralized ERP?

The Simple Answer: Decentralized Solutions Have Higher TCO

The consequences of a decision to decentralize are higher initial implementation and ongoing ownership costs. The implementation of a single vendor's ERP (e.g., SAP) solution in many locations without centralized standardization and control will result in

multiple (often widely varied) configurations, or instances, of the ERP application. Each deviated configuration will require unique training and support capabilities. Other areas of non-standardization will also increase ongoing costs, because each unique technical environment will require uniquely qualified support personnel.

Decentralized solutions also multiply the Logistics ERP landscapes and the attendant system administration staff. Further affecting the decentralized scenario is the work required to periodically consolidate operations and financial information from unique ERP instances.

An added twist occurs if multiple vendors' solutions are implemented at different business (organizational) units within an enterprise, rather than separate instances of a single ERP product. This causes higher TCO because custom-built integration code, data alignment issues, and variations in vendor-centric business processes require extra time and resources to implement and maintain.

This type of implementation scenario is becoming rarer in today's cost-sensitive Logistics ERP climate. Individual business units are feeling increasing pressure to embrace new enterprise technical, functional and data architecture standards, especially when an ERP consolidation strategy is driven by new business requirements.

General Trends: Instance Strategy for Single-Vendor ERP Deployment

Gartner has published research that addresses the general question of how many production systems should be used in a particular ERP deployment. Although this research refers specifically to SAP deployments, it includes material that is relevant regardless of the vendors evaluated. In recent years, Gartner has observed a consistent trend toward minimizing the number of instances (i.e., "controlled redundancy") within any given enterprise. There are three major reasons:

1. It's more expensive to build, operate and maintain multiple production systems.
2. Application functionality across multiple systems diverges over time, making it difficult to get consistent views of vital business data. This causes duplication of master data describing customers, materials and products, and it increases the number of reports and the need for reconciliation across systems.
3. Globalization is a reality for many enterprises. This requires standardized business processes whenever possible. It's simpler to harmonize and standardize business processes on a smaller number of production systems, that is, using a centralized approach.

General Trends: Standardizing and Centralizing Deployments of Disparate Vendors' Solutions

Not all enterprises start with a clean slate. When an enterprise has grown through acquisitions, or previous Logistics ERP strategies have supported decentralization (in the case of the Army), numerous vendors' products may be installed in various forms. The benefits described for the single-vendor deployment still apply. However, added factors may tip the scale toward a less-than-completely centralized solution. When the anticipated benefits are not measurable—or they appear to be low in value or priority to the business unit or the enterprise entity—the costs of retiring the legacy solutions and deploying the enterprise standard may be too high. Likewise, when business processes vary significantly by business model, one standard ERP solution may not fit all business unit requirements.

Each potential area for centralization and standardization must be assessed in terms of deployment and transition cost vs. the increase in business value to the enterprise. Many enterprises are addressing the high-value areas first and letting costs and benefits drive the decision if and when to migrate the entire enterprise to the standard model. Others are developing separate small and large ERP models for use when there is a wide difference in business unit ERP requirements, including the amount of Logistics ERP support needed for each business unit.

The National Army and Field Army ERP initiatives are the high-value areas that need to be addressed first within an overall Army Enterprise Logistics Architecture.

ERP Consolidation Strategy

Because of the complexities involved in centralized vs. decentralized ERP deployment decisions, the enterprise stakeholders should have a clear understanding of the benefits of any proposed ERP consolidation approach. Numerous issues should be considered; however, on balance, most enterprises conclude that it's more cost-effective and of higher business value to consolidate along a more-centralized approach, unless:

- The enterprise prefers a highly autonomous approach to running its various business units, which would make it difficult to re-centralize
- The enterprise will achieve minimal business value from standardized ERP business processes (for example, if enterprise reporting for separate divisions is not a priority).

We've seen enterprises with a single vendor's solution deployed in a decentralized fashion opt to begin consolidation by simply moving all of their supporting ERP hardware into one physical data center. Although this first step does not address the issues of common data structures and business processes, it does have a positive effect on Logistics ERP costs and can be used to achieve Logistics ERP infrastructure standardization. A second step can be to adopt new server and disk storage consolidation technologies to further reduce costs.

Another challenge in consolidation occurs when portions of the enterprise outsource their solution to an Application Service Provider (ASP), like in the case of the LMP initiative. This makes consolidation of infrastructure more difficult and usually impacts the TCO negatively. A cost and risk analysis would highlight the possible go forward strategies to address consolidation with an ASP either by consolidation using the ASP (i.e., out-sourcing), joint operations (i.e., co-sourcing), ending the ASP support (i.e., in-sourcing) or some combination over time (e.g., out-source to co-source to in-source).

With a centralized systems approach, enterprises must correctly design the infrastructure to handle all classes of users. It's necessary to pay particular attention to proper server sizing, as well as the correct design of the wide-area network (WAN) infrastructure. This is achievable for most users, but the amount of network bandwidth required will increase over time with each new release of the vendor's product. Furthermore, it's just as important to optimize the strategy for providing disaster recovery and to design the right level of overall application availability into all production systems. In particular, consider using more-robust enterprise storage disk technology.

Potential Problems with the Centralized ERP Strategy

A single centralized ERP solution is not for everyone. One potential challenge to consider is mergers and acquisitions, which need to be planned more carefully with the centralized approach. This problem should not present a challenge to the Army's initiatives. In addition, some enterprises struggle to support upgrades and certain language combinations in a single ERP instance approach; however, this issue can be overcome based on Gartner research.

The centralized ERP decision also has major impact on architectural complexity as regards to system landscape design, the operational challenges of managing multiple languages and time zones, and business recovery issues. These challenges affect the design of application servers, graphical user interfaces (GUIs), and printer management and interfaces. However, real-world experience has shown that all of these issues can be overcome by careful design. Consequently, enterprises should factor globalization decisions into their ERP architectures and be careful with data center business recovery plans.

Human Capital Considerations

The decision to centralize will have significant impact on the Human Capital components of transition and governance. The organization structure will need to change, to support the centralization of resources. Roles, responsibilities, and competencies will change, to support a different way of performing Logistics ERP work. These roles, responsibilities and competencies will need to be defined prior to implementation to ensure clarity to the new 'rules of engagement', expectations, and ensure minimum disruption to the Logistics ERP organization and the various functions supported by ERP. This is often one of the most challenging aspects of centralization; as staff and leadership recognize changes to their roles are on the horizon, positioning, stovepipe thinking, and politics often influence important organization decisions.

Articulating a change strategy and plan, and including strong communications to various stakeholders, identification of key influencers, and identification of risks and risk mitigation actions will ease the transition for leadership, staff, and Logistics ERP customers.

Other Issues to Consider

Most enterprises that take the decentralized path tend to regret it unless they have very different business units with genuinely different business processes. Many large enterprises are totally re-implementing their ERP systems because they ended up with:

- Nonstandard ERP systems that share very little information, processes and knowledge—business and technical
- Significant manual intervention to consolidate business performance metrics and reports
- Much higher TCO due to "reinventing the wheel" or too many servers, storage, database software, software tools and related infrastructure
- An uncoordinated architecture.

ERP Central Competency Center (CCC)

The most successful enterprises have some form of CCC to maximize return on investment (ROI) by sharing knowledge and skills across the enterprise. The CCC is not a planning committee that meets a few times to write a report. It is a full-time, permanent group that operates as a public utility or service center on behalf of other parts of the enterprise.

A CCC has two kinds of responsibilities:

- The operational function maintains and monitors the infrastructure of the enterprise nervous system. This is a support job, somewhat similar to network or system management, except that it deals with application-level logic and middleware instead of lower-level network or server management technical levels.
- The development function helps developers in each application project team design and build their connections (adapters) into the integration infrastructure. This usually also involves assembling and maintaining documentation (interface metadata) for the application interactions. This is similar to a data administration or database administration function.

The potential benefits of a CCC include:

- Reducing the development time and effort required to document and code interfaces among systems by supplying methodologies, best-practice knowledge and common tools.
- Reducing redundancy in the integration middleware. The enterprise will have fewer file transfer, message-oriented middleware, broker, gateway, screen scraper, business process management (BPM) and other middleware products and, therefore, lower software license fees and less need for trained technical personnel.
- Reducing the time required to add or change applications and their connections with other applications by supplying experienced people to help application developers.
- Facilitating the reuse of business-object document standards and Web services interfaces.

Note that enterprises cannot entirely avoid acquiring multiple, disparate integration technologies because such technologies are widely embedded in packaged applications, development tools and middleware suites. However, the CCC can reduce the number of superfluous and redundant technologies. We believe that a well-run center will have a positive payback for almost all midsize- or large-scale integration scenarios, regardless of whether the enterprise uses ERP, commercial integration broker, BPM or other middleware products. The CCC works even if traditional development languages and utilities are used for integration.

ERP CC benefits

An SAP CC can increase the ROI derived from what is typically a large investment in SAP. While R/3 provides pure back-office functionality to some users, for users of certain

non-administrative modules it is possible to build real business differentiation over time with core R/3, third-party software and in-house development. However, expert resources are required to implement and tune unique business processes around R/3. For example, after the core modules have been deployed, R/3 can be integrated with the Internet and other packages to support the business plan. This opens up many possibilities for streamlining interactions with customers and suppliers. These benefits can be achieved only if the enterprise's internal expert R/3 resources can be retained. The following potential benefits can be derived from an SAP CC investment:

- Real system ownership from the business, by establishing a shared vision of building long-term business differentiation
- Increased revenue, by building unique business processes around customers
- Increased retention of key project staff, by senior management communicating this vision and making the CC a prestigious place to work
- Increased leverage of SAP knowledge, by using these key staff to focus on the SAP information available and sharing the knowledge across the business
- Enhanced opportunity for business collaboration, by encouraging greater standardization of R/3 configurations, data definitions and business processes
- Faster propagation of SAP knowledge around the business, by having a single point of contact for everyone
- Reduced attrition costs for expert internal R/3 resources
- Reduced dependence on (expensive) external consultants, through greater use of internal resources
- Reduced license and maintenance fees from SAP, if a value contract is negotiated
- Faster R/3 upgrades across multiple sites, by leverage of knowledge gained on the first one
- Reduced training and consulting fees from SAP in some countries, if negotiated upfront.

The last five benefits represent real reduction in SAP operational costs. Many listed items are tangible and high value. A drawback of the CC model is that special compensation packages may be needed to retain key staff in the SAP marketplace.

Bottom Line

Despite their low occurrence, Gartner expects numbers of SAP CCs to rise. The SAP CC model can yield greater ROI from SAP projects, resulting from building business differentiation over time as well as reducing ongoing SAP operational costs. All SAP enterprises should investigate the financial feasibility of this approach as soon as possible.

Who Owns the Logistics Business Processes

The Army logistics applications and systems are moving across enterprise boundaries, which means that business process ownership is pivotal in facilitating collaboration within the Army and among other enterprise stakeholders. The Army should implement a business process team that coordinates tightly with LSM and FLE architecture teams. Collaboration requires integration, and integration requires a comprehensive understanding of business processes. But as the Army becomes a link in multiple extended value chains, their processes and workflows cross many boundaries. ERP and business staff must therefore work together, understanding and exploring business process management (BPM) in its business and technical contexts to create a collaborative environment, protect knowledge and manage processes.

Rationale for Management Oversight

The "management" in BPM becomes a challenge when Type A and Type B enterprises (early and moderate adopters of new technology, respectively) face major restructuring, mergers and acquisitions, or large-scale implementations of new systems, such as ERP.

On the ERP side of business processes, the same difficulties arise, but with a technical twist. IS departments of the merged enterprises must unravel incompatible workflow applications to address "new and different" business needs — the work-arounds created by the employees on the business side. In turn, the ERP work-arounds create new steps in the process on the business side, which the customer facing employees must deal with, resulting in new work-arounds and additional problems for the IS organization, such as increasing costs of processing, maintenance and support. This downward spiral saps the productivity and quality of the merged enterprises and is eventually reflected in falling customer satisfaction, poor employee morale and increasing costs.

Who Owns the Processes?

Midsize and large enterprises have created many processes that interconnect their own business units as well as connect them with other enterprises. This can make finding the process owner difficult. To solve this problem, we recommend two approaches:

- Decentralized: Form a committee represented by the heads of enterprise business units. This guarantees synergy between business units, multiplies knowledge of processes and gives the benefit of building skills for people who will be able to manage processes with a standardized strategy. This strategy is best used when priorities are:
    - Enterprise integration
    - Responsiveness
    - Local control
    - Rapid development
- Centralized: Create a self-controlled business unit that will manage all processes. This strategy, which guarantees a unified approach, is best when priorities are:
    - Value chain integration
    - Economies of scale
    - Asset protection
    - Architectural control

Both methods result in a business processes team (BPT). Its main roles are to:

- Manage the enterprise's processes while keeping an eye on "the big picture": not just business units, but customers, partners and providers. The ability to plan and integrate processes is mandatory.
- Focus on process management (i.e., improving productivity during new and old processes). Design, modeling and integration are key.
- Avoid conflicts between the business and technical sides by translating from business to technical language and vice versa.
- Act as a repository for information on the entire business process chain. The BPT will need to work with the technical staff to address:

Application integration. How departmental applications exchange data with enterprise systems, such as management information or decision support systems.

Business process interoperability. Determining which standards allow interoperability between existing solutions from different vendors, especially when solutions are installed in multiple environments using different features.

Security. How to preserve business processes that flow inside from outside, and vice versa; for example, by adopting standards like XML that allow process management without giving access to enterprise knowledge to unauthorized users.

Disaster recovery. How critical hardware and software functions can be redirected as many enterprises' transactions become interdependent.

Scalability. Determining performance and time response needs. Large enterprises, such as banks, with large numbers of customers and concurrent processes, require the most-detailed plans.

Availability. How procedures and automated business rules guarantee effective failure tolerance for critical processes.

Tracking. How to log and save relevant information for further improvements in the enterprise's business processes, particularly for different types of processes (internal and external) to be analyzed.

Monitoring. How to develop, buy and integrate mechanisms that verify the status of individual processes. Useful in all process situations, starting from processes that flow between departments to processes that cross different environments and value chains.

> **Bottom Line**: As enterprises grow more complex and interdependent, the importance of business processes ownership increases accordingly. To manage and align business processes that may be: 1) occurring in different business units and multiple value chains, and 2) running on different ERP infrastructures, enterprises must decide who owns their processes. The BPT is an effective answer.

How to Implement a Successful ERP

In these tough economic times, many executives are looking more closely than ever at the costs, benefits and return on investment of major project implementations in their

enterprises, including ERP projects. Gartner discusses how enterprises can make their ERP projects successful by managing six critical aspects of the implementation.

ERP Market Overview

The journey of process improvement continues from automation to integration to — now — collaboration. Before the recognition of business processes, users deployed applications that automated manually intensive, calculation-oriented functions like financials or MRP. These functionally oriented point solutions worked well, but they lacked native integration. After becoming "process aware" in the mid-1990s, enterprises quickly realized that simply assembling existing functions into processes would not be efficient; thus, users launched business process re-engineering efforts. The integrative requirements of these new processes drove enterprises to ERP for process integration across a complete application suite. Now, with processes both automated and integrated, users continue to seek ways to apply new technologies to improve business processes. Figure 3 shows the current migration from MRP to ERP to ERP II.

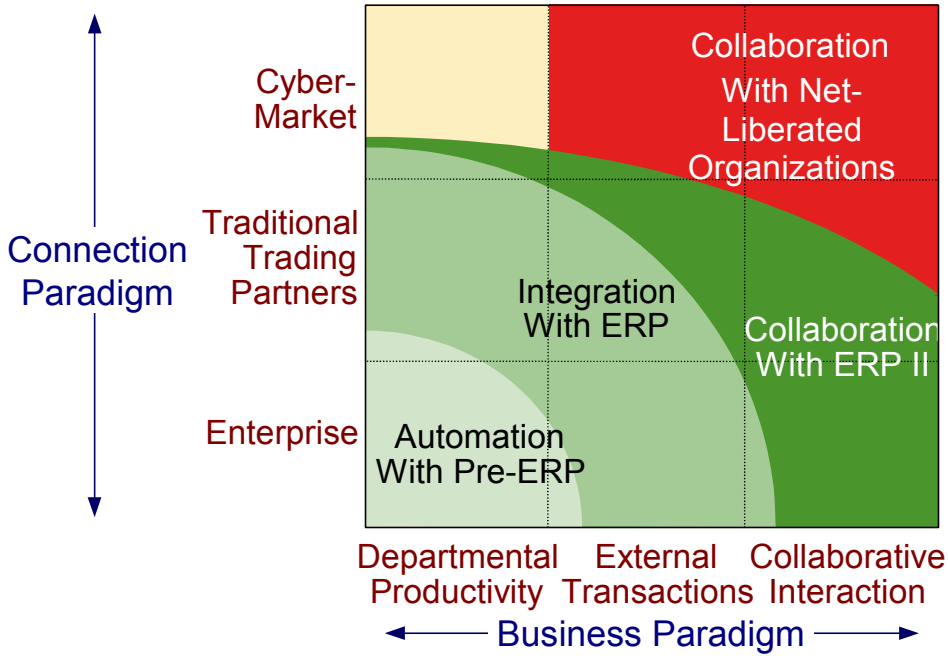


Figure 5.3: Process Improvement Journey

Enter collaboration. While collaboration, in the purest sense, has always been an integral part of business, the application of technology to collaboration is truly new. Applying these technologies to business processes is the next area for process improvement. Where these processes are commerce-oriented, we will enable c-commerce through ERP II.

Action Item: Before attempting collaboration, enterprises should deploy ERP II.

ERP II is an evolution from ERP that extends business processes, opens application architectures, provides vertical-specific functionality and is capable of supporting global enterprise-processing requirements. As enterprises become more focused on core competencies and become part of more virtual enterprises, they must deploy applications that are capable of handling internal processing requirements, but are also capable of

providing business partners with access for integrated processing, self-service and performance management. To support those extended processes, applications must change architecturally to enable easier integration and information access.

The Army finds itself in a unique position to learn from commercial best practices along the process improvement journey. The Army will have a unique opportunity to learn from commercial best practices and potentially move more quickly through this evolution process (shown in Figure 5.3) to get to an integrated and automated "Factory to Foxhole" collaborative environment. In any case, as the Army develops its current Enterprise Architecture and moves toward a "One Army" logistics architecture it must also keep its eye on the future to achieve successful collaborative processes.

Besides the processes and technical connectivity provided by ERP II, enterprises continually seek applications that are more tuned to their specific environments. Those vertical-specific processing requirements, as provided for in ERP II, will continue to drive the most differentiation between vendors. As more enterprises are challenged to operate in the global market as global enterprises, vendors are forced to provide products that are culturally neutral in language, currency and statutory requirements.

How to Avoid ERP Project Disasters

Because of bad press, negative perceptions or experiences, and previous project failures, many enterprises are wary of ERP projects and specific vendors. Although lessons can be learned from other projects — and those lessons can help enterprises separate implementation facts from fiction — just because a similar enterprise succeeded or failed with a certain vendor doesn't mean yours will. Gartner explores six critical issues that, if managed correctly, can keep an ERP project from becoming a disaster.

1. Manage Expectations — The Why

Expectations for business improvement are set early in the implementation process, and they form the foundation for all measures of project success. It's easy for enterprises to get excited by the promise of a better future enabled by ERP, with market hype, glitzy demonstrations by overzealous salespeople, and consultants promising drastic business improvements. Enterprises often create inflated expectations of the capabilities of applications, looking to them to answer all that's wrong with an enterprise. In terms of the demonstrated ability of the applications to meet business needs, the expectations are often unsubstantiated by facts.

The inflation of expectations is most significant during the software sales cycle. Salespeople often demonstrate what "sells" instead of what the enterprise needs. For instance, a supplier portal may look great in a demonstration and have tremendous benefits, but may require an enterprise-wide, integrated back-office system. The enterprise is likely to require that the backbone be deployed before the full portal benefits can be realized. If that happens, the initial "go live," without the supplier portal, will not meet the expectations set during the sales cycle.

Actions to Take:

- Carefully set realistic expectations and then manage them throughout the implementation process, as project conditions evolve.

- Complete this foundation with a detailed statement of expectations that relate business process change and application functionality to specific business benefits (the business case).
- Make improvement targets visible to the implementation team throughout the project, so the team can remain focused on business improvement.

2. Know Your Scope — The What

The scope of the project provides an overview of the degree of complexity involved. The larger the project, the more risk is involved, the more challenging the project is to manage and, ultimately, the more likely the project is to fail. Scope can have many dimensions, including applications, processes, geographies, locations, users, and significant organizational and ERP infrastructure changes. The larger the project, the more likely it is to fail. Enterprises often try to do more than is realistically possible when considering the scope of an ERP project, especially when the constraints of time, money and people are considered. Consequently, some enterprises fail to deliver the project as planned, while getting mired down in complexity. Enterprises often must revert to a reduced scope to make a planned deadline or extend the project deadline (and increase the budgets), while executing on planned scope.

Actions to Take:

- The Army should be realistic about what is achievable in the time frame of the project. If benefits are not achievable with 18 months, the scope of the project should be adjusted to deliver benefits sooner.
- The Army should plan projects with the ideal future state in mind, but execute efforts that move the Army logistics from the current state to the future via a few transition states. This incremental, coordinated program approach will enable the Army to derive value throughout the program and will enable it to respond to changes in the operational (business) environment.

3. Pick the Right Approach — The How

The answer to the scope question is only half the story, because the implementation approach is greatly correlated with the scope. Enterprises with limited scope are often able to embrace a more aggressive implementation approach. Likewise, a more complex scope requires more measured implementation approaches. Gartner has related those two dimensions of project planning (see Figure 5.4). Enterprises should avoid the combination of high complexity and a “big bang” approach, because the amount of effort required for success is often more significant than anticipated.

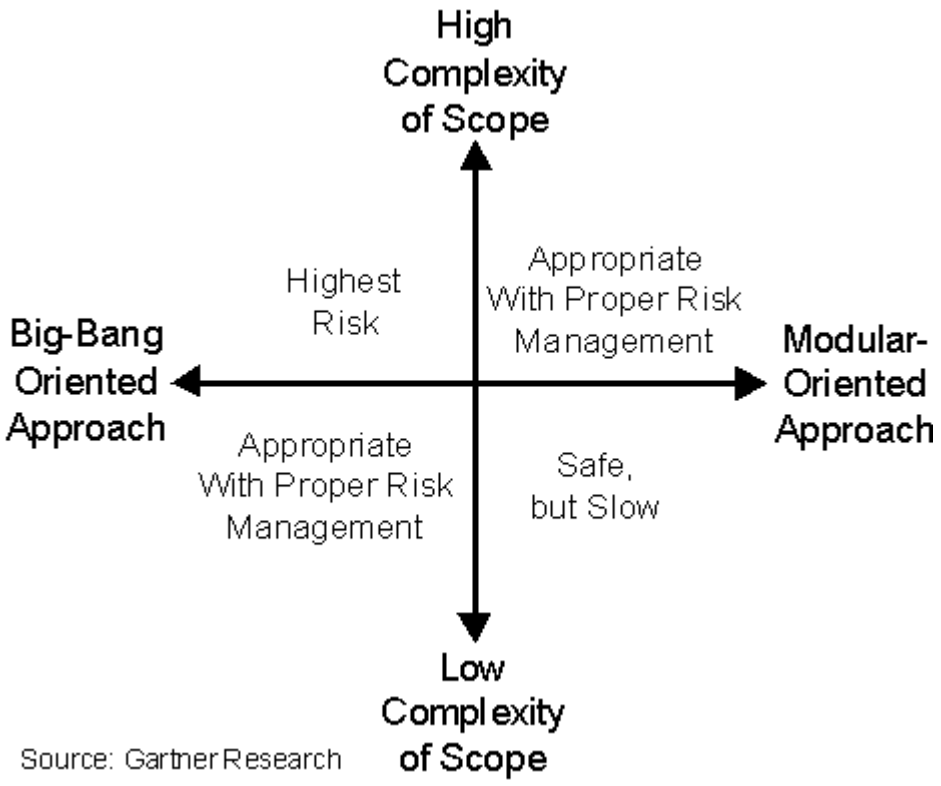


Figure 5.4 The Dimensions of Project Planning

Actions to Take:

- The Army, with high degrees of complexity, should avoid big-bang implementations in favor of more modular implementations that address the varying dimensions of scope in realistic, implementable combinations.
- Enterprises with simpler environments can explore more comprehensive implementations, with appropriate risk management strategies, to drive benefits earlier in the program.
- Enterprises with a simpler scope can pursue modular implementation strategies, recognizing that project risks will be reduced, but project benefits will be delayed.

4. Focus on the Users — The People

ERP projects are composed of people, processes and technologies. Often, the people dimension has the greatest impact on project success. Another key factor in change enablement is the culture of the enterprise. Enterprises that have historically had issues with change tend to continue to have those issues. Enterprises that embrace change and can more easily transform themselves will fare better when conducting those initiatives.

Actions to Take:

- Enterprises achieving success typically pay significant attention to the following:
    - Communication. Communicate about the project to the enterprise, on a regular basis, throughout the project.
    - Consistency. Consistent messages originating from the project team create a consistent view of the project within the enterprise.
    - Inclusion. Include people not directly involved in the project in such activities as validation of design and conference room pilots. Because the project will affect people from other enterprises, those external parties will require attention and involvement.
    - Education. This helps people understand why the project is important, what the organizational benefits will be and provides them with knowledge required to assist in achieving the benefits.
    - Training. This prepares users for the changes to their daily activities.
- In addition, enterprises embarking on ERP implementation should assess their organizations' potential for change readiness and change capability, and create specific change enablement plans to address those requirements.

5. Have Committed Sponsors — The Backers

Gartner research indicates that enterprise projects owned by a business unit (instead of the IS organization) and with sustained executive involvement have a greater chance of success than those that place ERP solely in the hands of the IS organization. Executive involvement reinforces the importance of the project to line managers and other people who are tasked with project execution and eventual deployment to the business. As is the case with cultural issues, this area has little to do with the actual application selected, but can have a significant role in overall project success.

Actions to Take:

- The Army should ensure business executive sponsorship, ownership and commitment throughout the life of the project.
- Involve executives in steering committee meetings, quality reviews, issue escalation and conflict resolution as discussed later in this report in the sections on Governance.

6. Avoid Modifications to the Package — The Enabler

Two specific dimensions are related to the package that must be clearly understood:

- The ability of the application to meet the needs of the business
- The willingness of the business to adapt to the capabilities of the application

The combination of those dimensions is different for all processes within each enterprise. One enterprise may see a need to customize an application, whereas another may be able to embrace it as delivered. Although most ERP projects have a guiding principle to "use the package as delivered," enterprises often find reasons to stray from that directive,

and, in those decisions, they put their projects at greater risk for failure, because customization efforts often take longer and cost more than planned.

Actions to Take:

- The Army should understand what customizations are required to meet industry-specific requirements (i.e., the Bundeswehr implementation) and plan for similar efforts as part of their implementation effort.
- In addition, the Army should perform their own gap analyses to determine where other customizations may be required and then analyze the specific business value associated with each gap to determine how the issue should be resolved.

Bottom Line

- Since ERP implementations are risky endeavors, the Army must take control of its own destiny.
- Relying solely on lessons learned from similar implementations at other enterprises or assuming that the merits of the selected application will ensure project success is not enough.
- Instead, the Army should define project management and implementation strategies tailored to their unique circumstances, addressing the people aspects, as well as the project execution strategies.
- Inattention to those fundamentals causes project failure, so follow the basic strategies and insist on top-level commitment to adherence throughout the project.

Case Study - How Procter & Gamble Runs Its Global Business on SAP

Unlike most large enterprises, P&G has successfully standardized around applications from one ERP vendor to enable harmonized global business processes and an integrated supply chain.

Key Issue

How will successful enterprises select, deploy and manage ERP II solutions to minimize risk and achieve optimum ROI?

Procter & Gamble (P&G) is a highly successful consumer packaged goods company (with around $40 billion in sales revenue) that runs many of its core business processes on SAP applications. P&G has adopted an enterprise resource planning (ERP) standardization strategy around SAP and has implemented a centralized ERP and supply chain backbone that delivers significant economies of scale while still enabling flexibility to support the company's business plans. This has been achieved by adopting a hybrid approach of global and regional/business unit instances of SAP applications, with a thought-leading approach to master data integration. We examine the key success factors behind P&G's exemplary SAP implementations.

Problem

P&G is a large-scale, global enterprise. Its business model is founded on global brand management, with global business units and a go-to-market approach of geography-based market development operations. To stay close to all consumers, a challenging balance must be struck between delivering consistent, globally aligned business processes while still providing flexibility to meet the needs of local geographies. P&G started its relationship with SAP in 1987, after which it quickly initiated a regional implementation of the R/2 mainframe application. In 1994, P&G started to switch all of its regional ERP applications to R/3. The major change came in 1997 when P&G embarked on a harmonized global SAP deployment strategy to support its strategic move to standardized global business processes.

Objective

P&G's global SAP project had three main objectives:

1. To fully deploy harmonized business processes for financials, HR and the supply chain by July 2002, in order to leverage scale globally.

2. To "Webify" the company and enable an integrated, consumer-driven supply chain.

3. To build in upfront flexibility for P&G's future business plans by enabling both robust, large-scale ERP operation and streamlined execution of future business mergers, acquisitions and divestitures.

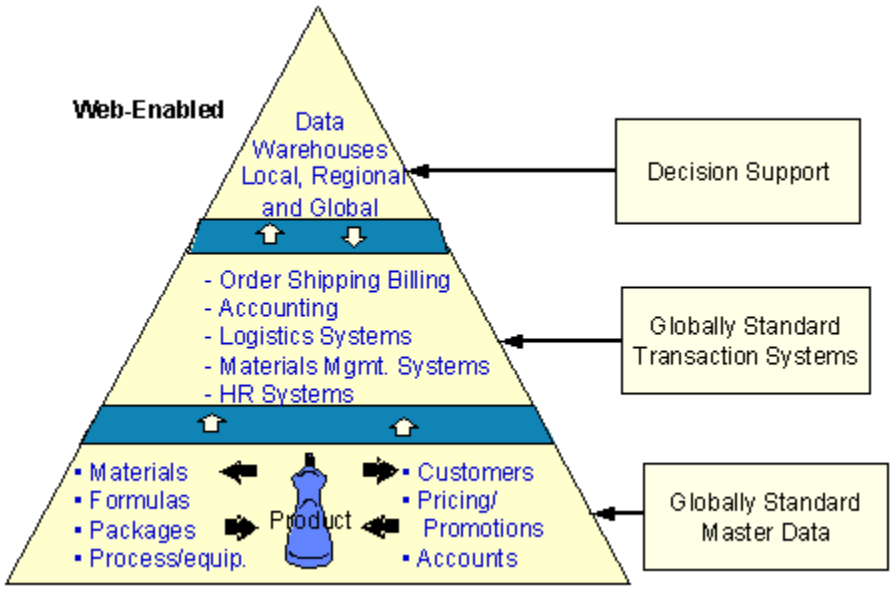
An immediate example of the latter is P&G's recent successful acquisition and merger of Clairol's $1.6 billion hair care, hair color and personal care business into the P&G beauty business.

Approach

Very early on, P&G identified five key strategies for its global SAP deployment approach, all of which proved to be critically important. They are:

1. Three-Layer Data Model

P&G decided to centralize business processes wherever possible. However, due to the sheer scale of P&G's business, multiple SAP production instances would be inevitable, potentially leading to data integration and synchronization problems that could challenge the vision of a globally integrated supply chain. Therefore, P&G designed a clever three-tier data model (see Figure 5), as a fundamental building block to facilitate business process harmonization across multiple SAP instances.



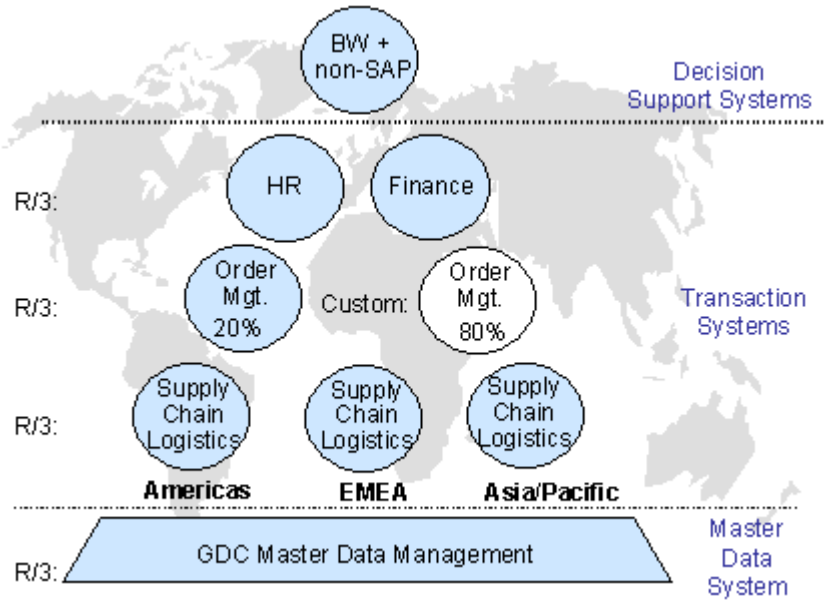
Source: Procter & Gamble

Figure 5.5: P&G's Three-Layer Data Model

All business master data is rigidly standardized and managed globally by one dedicated organization. This master data is maintained on one specialized R/3 system — the Global Data Client (GDC) — and has proved fundamental to P&G's success. This standardized master data underpins a number of separate but fully standardized R/3 transaction-processing systems. The top decision support layer of the pyramid is highly effective by virtue of the tight integration with the transaction-processing layer within the data model. P&G uses Business Information Warehouse (BW) for supply chain operational reporting and some management decision support, but the bulk of the financial management reporting is handled through its internally developed corporate data warehouse (based on Oracle). BW became much more important as further mySAP applications, such as Advanced Planner and Optimizer (APO) and Enterprise Buyer Professional (EBP), were subsequently deployed.

2. Physically Distributed, Logically Integrated Applications Architecture

P&G implemented single global SAP R/3 instances for each of finance, HR and capital management to support its global business process strategy. Figure 6 depicts the main ERP systems against the three-layer data model.



Source: Gartner Research

Figure 5.6: P&G's ERP Systems Architecture

The central finance system handles the closing of the books across all operations, but production costing is deployed at plant level, to define standard costs by plant. All employees are managed globally through the SAP HR system. Some payroll for plant operations is still handled through local systems. However, P&G will pay all staff for 10 key countries (including the United States) through its shared service center using SAP Payroll within one year, and has plans to progressively move the other countries to this model.

P&G also implemented multiple identical logistics instances for its supply chain systems, which were organized either by geography or business unit, as required. Figure 6 shows the principal three large regional logistics instances that together manage 110 physical sites. The three-instance approach was dictated due to sheer size, business risk and "upgradability." Although these instances have a single supply chain template, it is designed by the central development team to include all required processes, thereby capturing local requirements and practices in a common template. So, flexibility is achieved through a single, flexible template rather than local "add ons."

Around 80 percent of order management is handled separately by two large in-house-developed mainframe applications that are linked to the SAP systems. Figure 6 shows the GDC reference system, which also synchronizes master data for non-SAP systems. SAP's Application Link Enabling (ALE) middleware was selected to drive master data synchronization but, at the time, this was very much an emerging technology. Master data synchronizations take place at regular intervals of 10 minutes, one hour or one day, according to business need. The GDC system carefully validates all master data for uniqueness, and filters individual data to the right transaction systems. ALE is also used to link some transactions across SAP instances.

> As a consequence of this pragmatic instance strategy, P&G has deployed 38 separate SAP production systems, based on Unix and the Oracle database. Around 25 of these are relatively small systems (not shown in Figure 6), with fewer than 100 concurrent users each, to serve separate small business units

or specific languages (e.g., Japanese, Korean, Russian). However, the largest regional logistics system has more than 1,500 concurrent (11,330 registered) users and more than 1.2TB, even after data archiving. This is the North American Supply Chain System, which serves the needs of around 40 manufacturing plants. Individual SAP production systems operate on a range of different service-level agreements, according to individual business unit requirements. All hardware is located in three regional data center hubs. Each year there are two technical and one full business integrity disaster recovery rehearsals.

3. Global Development Model

All application development is done centrally through P&G's integrated Global Development Environment (iGDE) to enforce a single source of change, but a virtual organization is used to ensure local representation. The iGDE landscape features just two development systems: one for finance and logistics, plus one for HR that has a faster change cycle. This delivers benefits in terms of speed of rollouts, changes and upgrades. An acceptance client exists for each type of SAP instance to closely mirror the production system environments. All production systems are maintained on identical software release levels, currently 4.5B for R/3. All logistics production systems are identical in terms of configuration. Critical fixes to production systems are controlled through a separate "reliability" system that feeds back to the development system for consistency. All other fixes to production systems, e.g., tested SAP Hot Packs plus P&G custom code, are implemented on a quarterly cycle using a rigorous change control process that is FDA-compliant. The development organization is also responsible for third-level support of really difficult problems, and proactive evaluation of new products and tools.

4. Global Support Model

A single global, virtual organization is again used to support all users of the P&G live SAP systems. First-line support uses local superusers within local business units and geographies. Second-line support is performed by the P&G virtual SAP Competence Center (CC) organization, which uses ITIL standard processes for incident management, problem management and change management. These processes are integrated with the project implementation teams and the global development organization. The SAP CC can provide 24x7 follow-the-sun support worldwide from just four locations. This is because all business processes and SAP configurations have been standardized. Proactive support services, including infrastructure capacity planning, are routinely delivered. P&G's global SAP support exploits the strong company quality ethic to optimize process accountability and the open reporting of internal P&G customer satisfaction with support services.

5. Business and ERP Resources

Most enterprises have an expensive heavy dependence on external consultants for the implementation and support of SAP software — P&G does not. As a nominated "global account" of SAP, P&G has benefited from a particularly close relationship with SAP, which means access to real product experts. However, P&G has always pursued a strategy of building self-sufficiency and depth in SAP skills within its own staff. This means that both the global development and implementation/support organizations, which together make up the P&G SAP CC, have a very high level of business and technical SAP expertise. This provides great agility and large savings in consulting expenditure. P&G currently has 550

staff members in supply chain and 450 employees in financial/HR applications within its SAP CC.

Results

Unlike many other enterprises that have attempted to standardize their ERP systems, P&G has been highly successful in deploying a global ERP and supply chain backbone. By summer 2002, all finance and HR were handled through R/3 and about 90 percent of the manufacturing sites planned to use R/3 for materials purchasing, supply chain planning and execution. So far, there are more than 45,000 registered users, of which around 5,000 are typically concurrent over the 38 production systems.

P&G has realized significant ERP economies of scale by standardizing on SAP and centralizing its infrastructure and support. However, it has also gained significant business benefits in visibility, consistency and accuracy. It has achieved global visibility in its supply chain and leveraged this in procurement, resulting in increased contract spending and stronger supplier relationships. P&G's overall quantified ROI remains confidential, but one example of significant saving has been the reduction of spare parts inventory for maintenance by implementing shared warehouses and linking these to SAP's preventive maintenance capabilities.

The consistently enforced P&G global data model and standardized approach to systems rollout delivers the flexibility to support the business. This means that acquisitions can be assimilated much more quickly than was previously possible, P&G's acquisition of Clairol being a good example. P&G anticipated the majority of Clairol's manufacturing systems would be converted to the P&G SAP environment by mid-2002. Acquisition success is measured in terms of adherence to the assimilation timetable established during the due diligence phase and smoothly completing the first month-end financial closure. P&G can also easily accommodate divestitures, as its approach allows it to quickly re-implement, on a stand-alone basis, any operations that may be spun off.

Finally, accuracy of planning and sourcing decisions has improved, leading to reduced excess inventory buffers. Greater data accuracy has also reduced administrative burdens in reconciling data inconsistencies, leading to more time for real data analysis and a faster closing of the books. In markets where SAP integrated solutions have been implemented, the time to close to corporate consolidation has been reduced by 25 percent. After mid-2002, when all financials will be handled through the global financials system, the goal is for full consolidation to be done by the fifth working day.

Critical Success Factors/Lessons Learned

Apart from adhering to its five deployment strategies, the "secret ingredient" behind P&G's SAP program has been the very close cooperation between the business units, the IS organization and SAP. There have been three other factors that P&G regards as having been critical to its success:

1. Top management sponsorship from the inception of the SAP program has ensured that the vision and architecture are in concert with the corporate business strategies. This sponsorship has provided the governance to support the transition to the global standards, allowing the implementation teams to concentrate on fast deployment.

2. P&G has established a network of regional business process owners that provide input to the development of the standard work processes and solution sets. This

allows innovative thinking and geographic differences to be captured at initial design, rather than handled as exceptions during implementation.

3. Ensuring retention of its highly talented staff has been key to allowing P&G to continue with its strategy of using in-house expertise to deliver its SAP program.

One of the key P&G learnings is that, while highly integrated applications like SAP give a net increase in productivity, work is redistributed in the organization. In particular, master data input requires more effort than it did for legacy systems, but the investment in this data accuracy creates benefits elsewhere.

P&G is rapidly expanding its core SAP applications. Further supply chain projects are well under way for the implementation of EBP, Investment Management, the APO and enterprise portals. To date, P&G has rolled out EBP to 4,700 registered users across 17 countries over an 18-month period, and intends to complete another 13 countries by July 2002. Nearly 300 suppliers are connected to P&G's supplier portal, processing around 1,300 transactions per month

Bottom Line

P&G has achieved what many other large-scale enterprises have failed to do: a standardized global ERP deployment with a centralized infrastructure that is flexible enough to support its global business plans. This has been achieved through a sound business strategy coupled with innovative deployment initiatives, leading to the realization of tactical and strategic benefits. Enterprises seeking to maximize their ROI in ERP deployment should carefully review P&G's strategies and critical success factors to help define their own optimization strategy. Such enterprises will need to strike a careful balance between central governance and local choice in all aspects of their ERP deployment or optimization strategies.

Logistics ERP Cost/ Benefit and Best Practices Summary

Several best practices (highlighted in the previous sections on Gartner Research) can significantly improve the Army's ability to field a successful Logistics ERP program.

First, and foremost, top management sponsorship of the ERP program is required to ensure that the vision and architecture are in concert with the top-level Army strategy. This top management sponsorship should provide and ratify a governance model to support the transition to the "One Army" architecture standards, to allow the implementation teams to concentrate on fast deployment.

Three organizational critical success factors that consistently make or break an ERP architecture initiative include:

- The Right Governance Model
- Organizational Change Management
- The Architecture Team Structure.

The Army should establish a business process team to understand and explore business process management (BPM) in its business and technical contexts to create a collaborative environment, protect knowledge, and manage processes. The Army logistics applications and systems are moving across enterprise boundaries, which means that

business process ownership is pivotal in facilitating collaboration within the Army and among other enterprise stakeholders. Collaboration requires integration, and integration requires a comprehensive understanding of business processes. A network of business process owners across the enterprise can provide input to the development of the standard work processes and solution sets. This also allows innovative thinking and organizational differences to be captured at initial design, rather than handled as exceptions during implementation.

Finding the correct balance of a centralized vs. decentralized solution through controlled redundancy (smart consolidation) will minimize total cost of ownership while best supporting the "One Army" architecture.

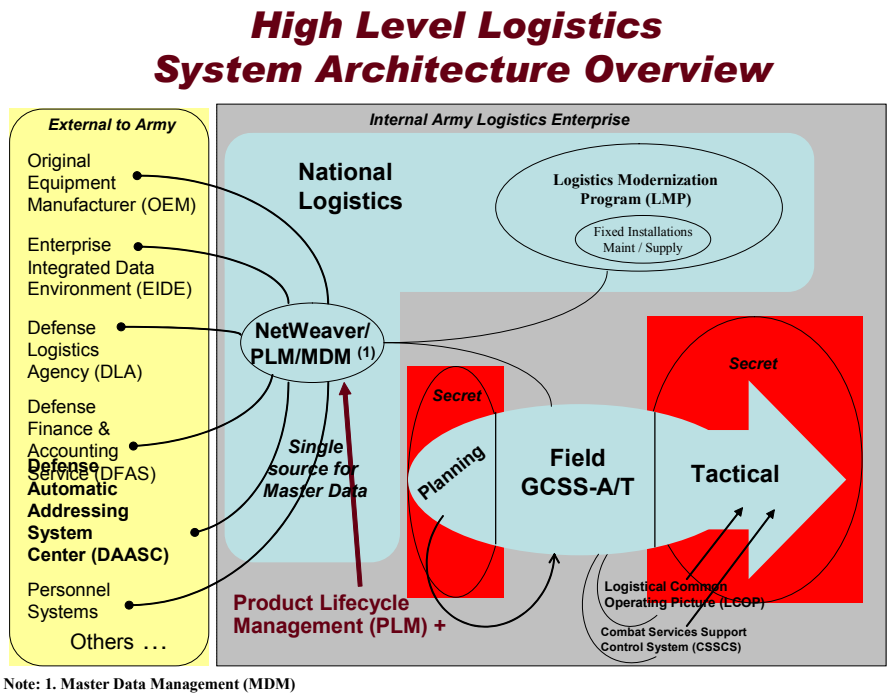
To further maximize return on investment (ROI), the Army should follow a best practices approach that most successful enterprises have in implemented some form of ERP Central Competency Center (CCC) for sharing knowledge and skills across the enterprise.

Chapter

6 Systems Alignment

High-Level Systems Architecture

The system alignment with the operational architecture is conditioned on leveraging the Army's investment in SAP. Hence, we do not start with a "clean slate," but further the investment with a bias on logistics enterprise integration. A key driver of our analysis is the desire to minimize complex interfaces, while leveraging the latest commercial technologies. Our recommended system landscape is reproduced as Figure 6.1.



Note: 1. Master Data Management (MDM)

Figure 6.1: Overview of Systems Landscape

The key component of the architecture is the hub that we call PLM+. This hub brokers master data across the two SAP investments, but it also serves as a key entry point to external constituents. Given the criticality of the hub, much of our time was spent analyzing its functionality and system capability. This section provides an overview of the system alignment, with the details following in later sections. In particular, the details of the hub are presented in the sections on NetWeaver, Exchange Infrastructure, and Master Data Management.

The overview of the hub from a total integration perspective is presented in Figure 6.2. To understand Figure 6.2, one has to understand the difference between integration and interoperability. Integration implies that all relevant data is instantaneously available without having to pass through complex interfaces. Some interfaces are inevitable, and these are indicated in the figure as "legacy." However, given our desire to minimize

interfaces, we stay within the integration domain, unless there is compelling evidence that integration should be violated. Hence, we preserve the integrity of the business process integration by staying inside SAP whenever possible.

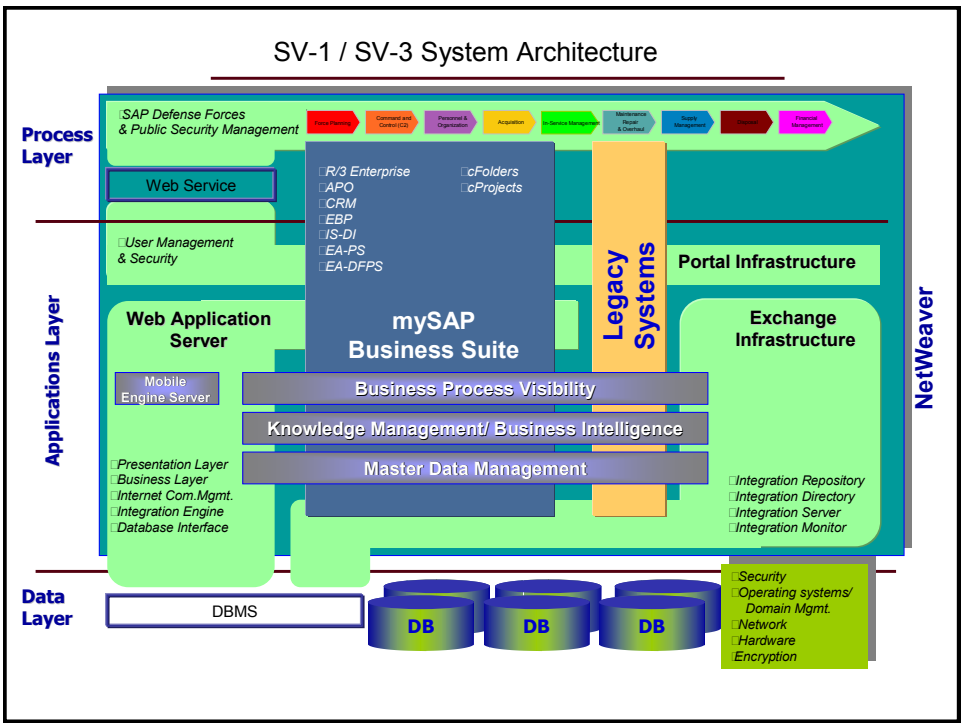


Figure 6.2: System Landscape from an Integration Point of View

On a more detailed level, the functionality of the PLM+ hub must be understood, documented, and aligned with the to-be business processes. The details of this architecture are presented in Figure 6.3.

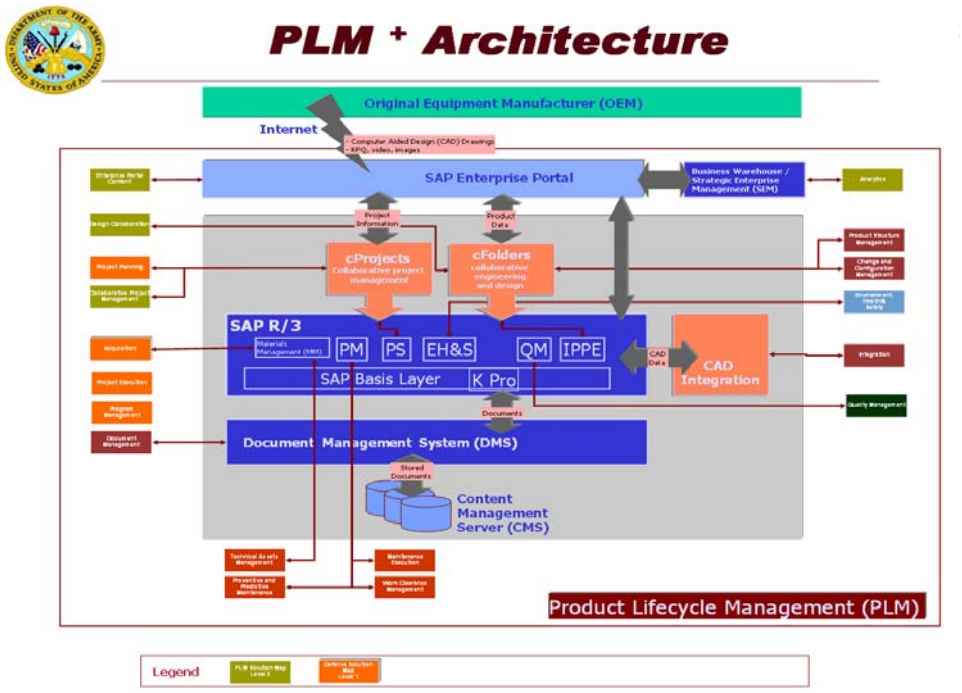


Figure 6.3: PLM+ Architecture Components

Our analysis indicates that SAP can meet the requirements at the PLM+; hence, preserving the integration across the Field and National Army. The preservation of the integration is critical for the Army to leverage its investment in SAP. By following this strategy, many complex interfaces are eliminated, and furthermore, optimized messaging[9] is ensured across all of logistics. Given the Army's previous investment, this architecture is the only pragmatic strategy for moving forward.

Aligning the Architecture with the Legacy Army

There are two alignment problems that must be addressed. The first alignment problem, discussed above, is the alignment of the to-be business process objects with SAP to-be system components. Given the business process orientation of DoD policy, this was relatively easy. The next mapping is the legacy army to the to-be business process objects. This provides the strategy for prioritizing the transition from the as-is to the to-be. In an C4ISR context, this is the point of an SV-5 view of the organization. Our SV-5 is presented in Figure 6.4.

[9] This concept is discussed in detail in the section on Exchange Infrastructure.

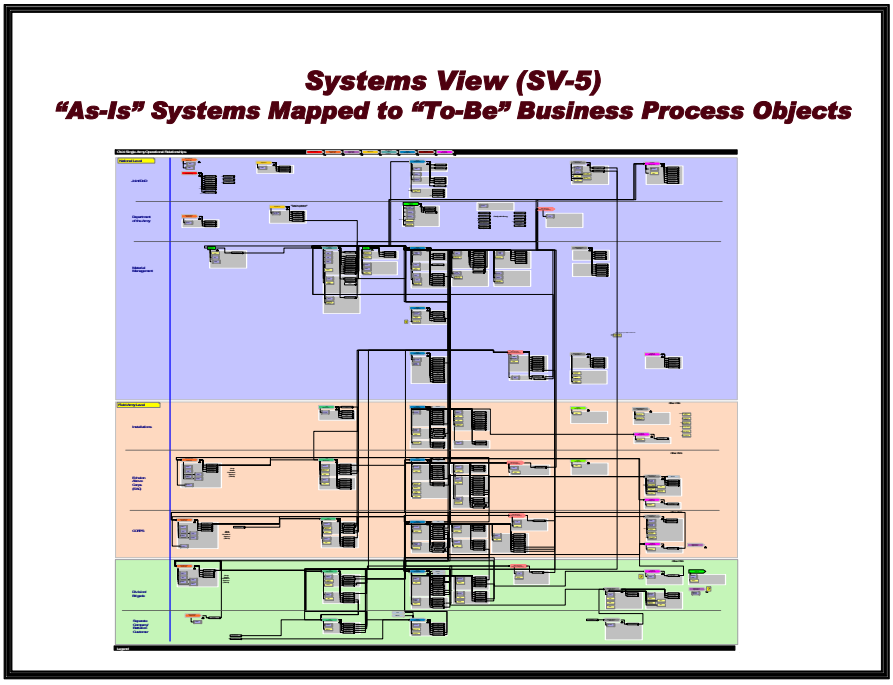


Figure 6.4: System View 5

This view is essential for mapping the system transition for the Army. We have demonstrated that most Army logistics business processes can be enabled by SAP. However, the Army acknowledges that multiple force configurations must be supported in the future; from the legacy Army to the Objective Force. This implies a complex transitional landscape. We were not tasked to complete the details of this transition, but this figure is the critical building block for each of those architectural configurations.

Summary

The details of this system landscape are discussed in this report. Our desire was to design a system landscape that

- Enabled the integrated logistics business processes,
- Maintained the integration domain,
- Achieved technical data integration,
- Provides a common operating picture,
- Provided for a single set of master data, and
- Minimized interfaces.

This system architecture efficiently addresses these requirements.

Chapter 7

Aligning Army Logistics with Policy-Level Architectures

Alignment with the Future Logistics Enterprise (FLE)

The Future Logistics Enterprise

The DOD has proposed a major transformation of the way that it plans for and executes logistics. This multi-year effort is called the Future Logistics Enterprise (U.S. Department of Defense, 2002). "The Future Logistics Enterprise (FLE) is an integrated set of six collaborative initiatives to achieve end-to-end customer service within Department of Defense logistics operations. The primary intent of the FLE is to accelerate the DOD's implementation of integrated logistics chains and commercial information systems to meet warfighter sustainment needs and the operational requirements of the National Defense Strategy. The FLE is focused on those mid-term policy, process, and systems changes the DOD must make in order to continue to effectively support our warfighting customers"

The Near-Term Strategy

"The Future Logistics Enterprise (FLE) is DOD's mid-term vision (2005-2010) to accelerate logistics improvement, enhance support to the warfighter, and align logistics business processes and infrastructure with the operational demands of the 21st century. The primary objective of the FLE is to ensure consistent, reliable support that meets warfighter requirements through enterprise integration and end-to-end customer service. The FLE builds upon and accelerates specific, ongoing Service/Agency initiatives to meet the requirements of the Quadrennial Defense Review (QDR) and the National Defense Strategy" (U.S. Department of Defense, 2002).

The Six FLE Strategies

The FLE is characterized by six initiatives:

1. Depot Maintenance Partnerships,
2. Condition-Based Maintenance Plus (CBM+),
3. Total Life Cycle Systems Management,
4. End-to-End Customer Service,
5. Executive Agents, and
6. Enterprise Integration.

Each of these initiatives is briefly discussed below.

Depot Maintenance Partnerships

The primary intent of the Depot Maintenance Partnership initiative is to enable and empower DOD-owned maintenance depots to expand partnerships with commercial

companies to enhance depot support to the warfighter, while fulfilling the national security need for the DOD to retain depot maintenance capabilities.

Condition-Based Maintenance Plus (CBM+)

CBM+ focuses on inserting technology into both existing and new weapon systems to support improved maintenance capabilities and businesses processes. The long-term goal is to integrate condition sensors and self-reporting technology directly into weapon systems so that the systems become a direct extension of the logistics chain. The "Logistics Chain" extends the supply chain to include maintenance and transportation functions needed to sustain an operating military force. The advent of this technology requires significant process and policy changes to achieve the dramatic improvements in logistics system responsiveness required to meet DoD strategic goals.

Total Life Cycle Systems Management (TLCSM)

The primary intent of this initiative is to improve weapon system sustainment by establishing clear responsibility and accountability for meeting warfighter performance expectations within the weapon system program management office. The weapon systems program manager will be held responsible for the overall management of the weapon system life cycle to include: timely acquisition of weapon systems, meeting warfighter performance requirements, integration of sustainability and maintainability during the acquisition process, and weapon system sustainment to meet or exceed warfighter performance requirements throughout the life cycle at best corporate value to the Services and the DoD.

End-to-End Customer Service (E2E)

The end-to-end distribution initiative is directed at streamlining warfighter support by providing materiel, including retrograde and associated information, from the source of supply or point of origin to the point of use or disposal, as defined by the Combatant Commanders, Military Services, or characteristics of the commodity, on a worldwide basis. The intent of the initiative is to influence acquisition, sourcing, and positioning to facilitate the flow of materiel to the end user, ensuring that deployment and sustainment are synchronized

Executive Agents (EA)

The Executive Agents initiative is aimed at improving support to warfighters by ensuring that roles, responsibilities, resources, and capabilities are responsive to the supported Combatant Commanders' deployment and sustainment requirements. The goal is to clarify responsibilities in the complex milieu of crisis/deliberate planning and during deployments of all types.

Enterprise Integration (EI)

To accelerate development of the FLE, this initiative builds upon efforts, underway within the Services and the Defense Logistics Agency, which successfully use commercial ERP and other commercial solutions to enable the business process requirements across the FLE.

The DoD recognizes that it will take many years to fully implement the FLE, including changes to policy, statute, infrastructure, and organization. This transformation requires a mechanism to facilitate on-going planning and analysis while providing a means to communicate changes to successive generations of civilian and military personnel throughout the defense establishment.

The FLE and the Financial Management Enterprise Architecture

Since February 2003, the FLE architecture and the FMEA are the same for the logistics domain. Since the domain of this study is Army logistics, this reduces the number of architectural mappings required by OSD. The details of the alignment procedures with FMEA are presented below.

The Future Logistics Enterprise and SAP

The FLE is a business process oriented initiative. The two major business process oriented tenets of the FLE are Total Lifecycle Systems Management and E2E Customer Service. These concepts are represented as end-to-end business processes, and they are the equivalent of similar private sector business process oriented initiatives. The similar initiatives are Product Lifecycle Management and Global Logistics.

Given the focus of commercial standard software solutions, it is intuitive that there should be some alignment with the FLE. For our purposes, intuition is insufficient. In our earlier worke, we have performed formal gap analyses between the FLE architecture and the two major end-to-end solution providers, Oracle and SAP. While we noted some gaps, in general the fit was quite good. Since the Army has made the decision to implement SAP, the gap of interest is the SAP gap. The results of the SAP gap analysis are presented in Gulledge, et al. (2003), but for this study, we only note that the SAP solution, if aligned properly and configured correctly, can be an enabler of the FLE.

The Future Logistics Enterprise and Army Logistics

The Army logistics architecture was designed with a business process orientation. The primary view of the Army architecture is weapon system lifecycle management. In short, the Army's logistics architecture was designed to align with the Future Logistics Enterprise. Given that FLE and FMEA are the same, then the Army architecture was designed to align with the major OSD architectural initiatives that define DoD logistics policy to be implemented by the Components and Agencies.

Alignment with the Financial Management Enterprise Architecture

Our strategy is to align the Army architecture with the FMEA, using the same strategy followed by the Navy. The overview of this alignment is presented in Figure 7.1.

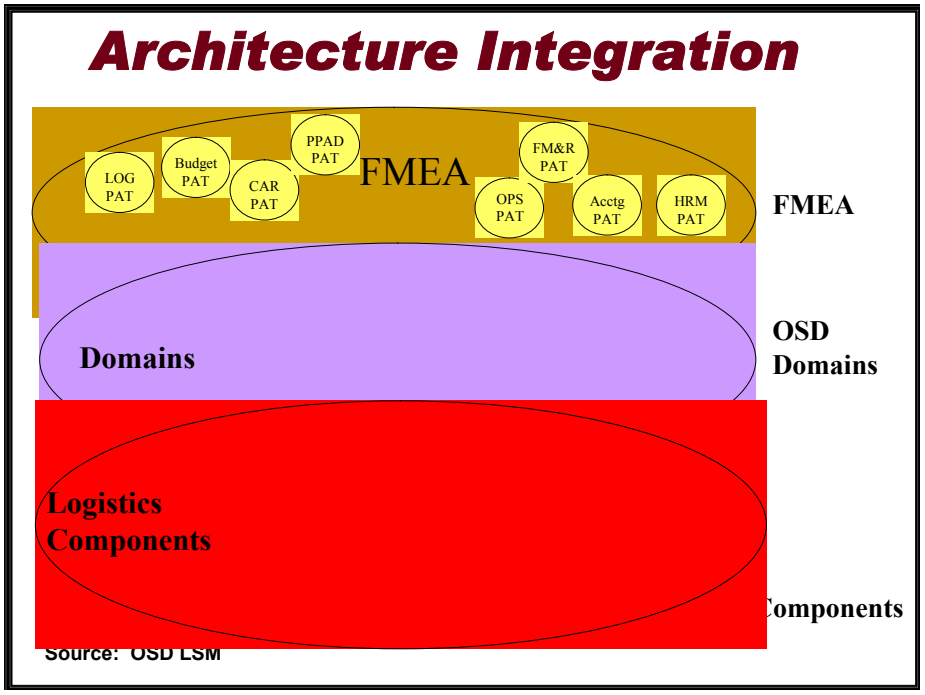


Figure 7.1: Alignment of Component Architectures with the FMEA

In Figure 7.1, the FMEA architectural requirements are passed to the OSD domain owners. At present, the logistics domain is leading the way, and the top level alignment between the FMEA and the logistics domain is complete. The test case for the lower level mapping is the Navy. As soon as the Army architecture is approved, the Army architecture will be aligned using the same process that the Navy is following. This process is presented in Figure 7.2.

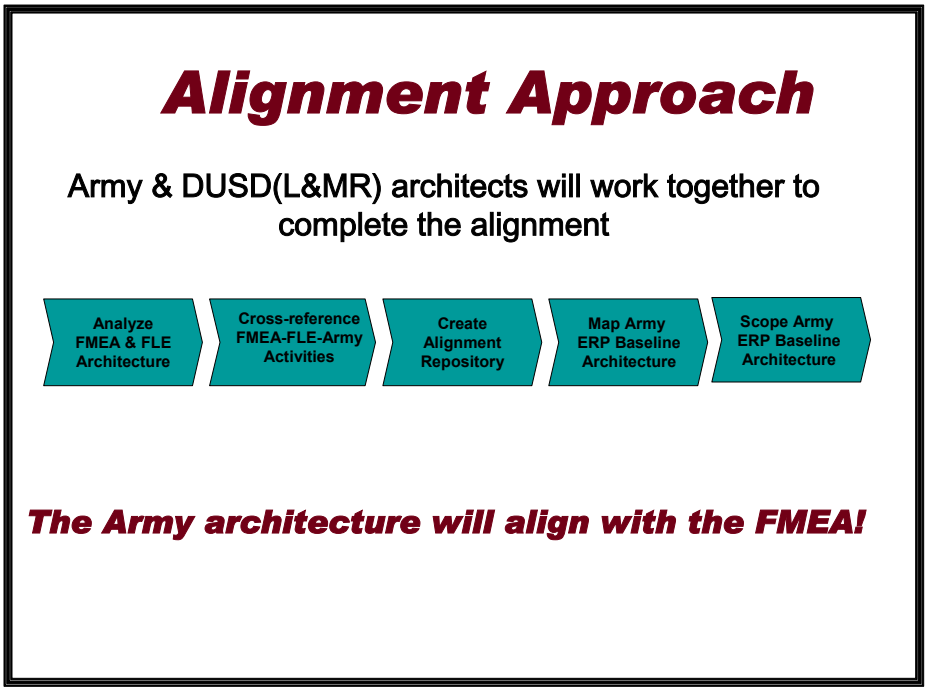


Figure 7.2: Approach for Alignment with the FMEA

Chapter

8

Details of the Army Logistics Architecture

The Functional Scope of the Single Army Enterprise

As a baseline for our architecture, we used the SAP Defense Solution Map[10]. The Single Army solution encompasses all objects on this map, which is presented in Figure 8.1.

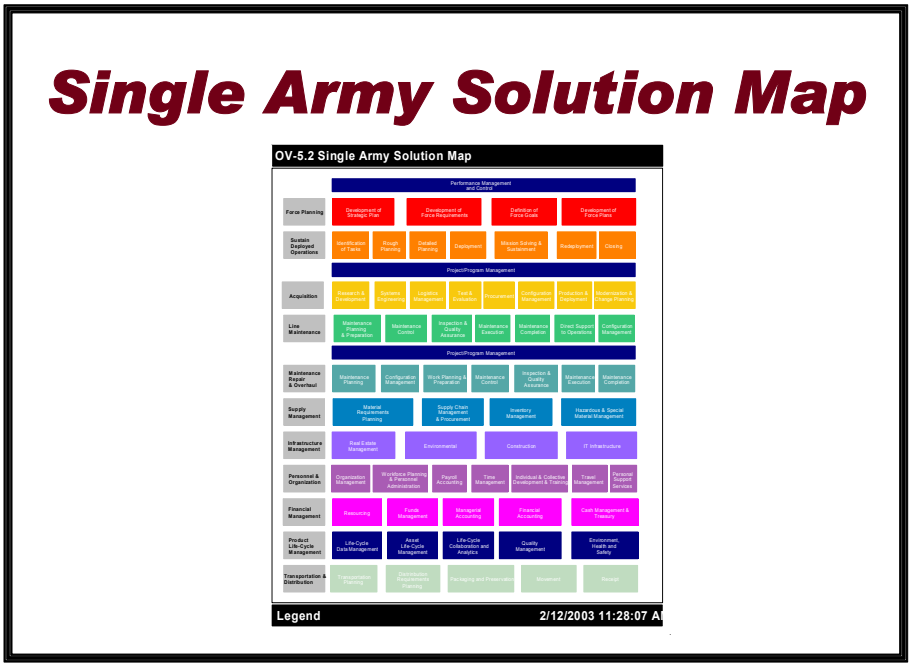


Figure 8.1: Single Army Solution Map

The single Army enterprise architecture is designed with a business process orientation that aligns with commercial standard software solutions. This alignment enables end-to-end business process integration, while at the same time aligning with OSD architectures for that require an end-to-end business process orientation. The highly aggregated Army is presented in Figure 8.2.

[10] The solution map is an aggregated OV-5, since it indicates all activities that are included in a particular solution.

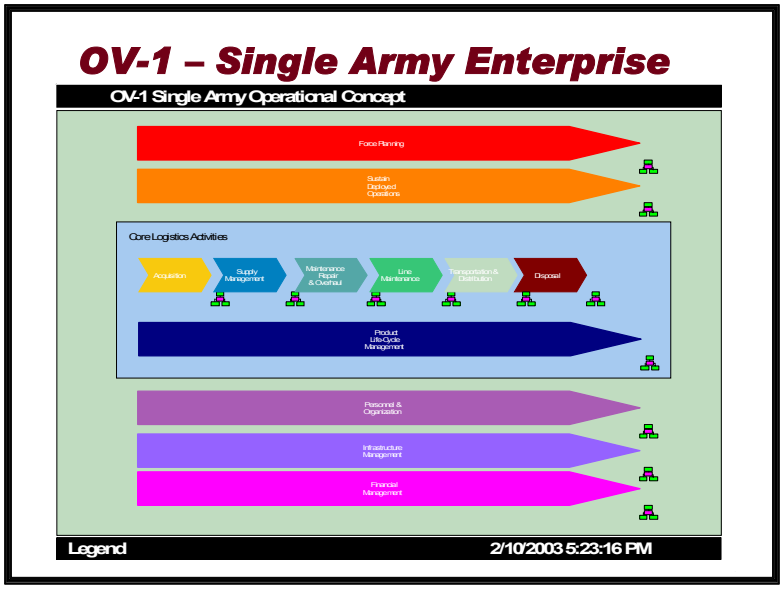


Figure 8.2: Single Army Enterprise OV-1

The value chains are designed to provide end-to-end business process integration. The details of the value chain are presented in Figure 8.3. This view is the Total Life Cycle Systems Management view for the Army. It demonstrates the end-to-end management of a weapon system, beginning at concept development and flowing to asset disposal. The model includes national Army and the field Army, which includes deployed and garrisoned forces.

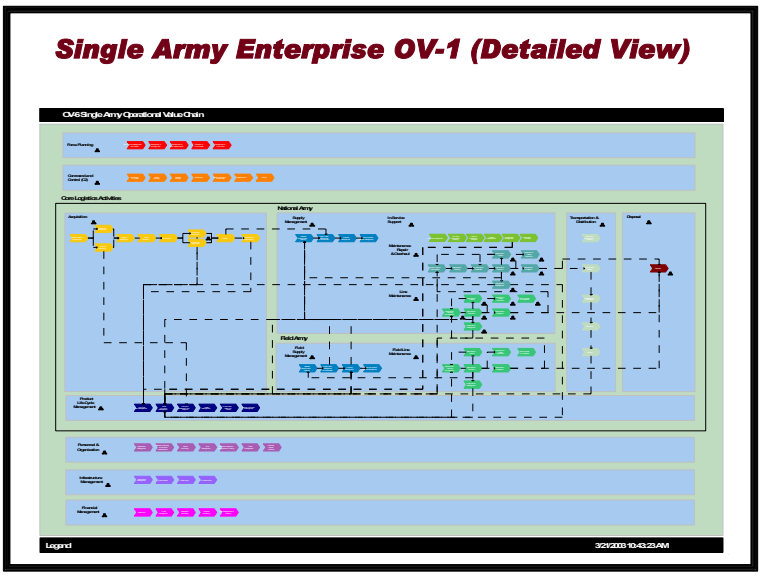


Figure 8.3: Detailed Army TLSCM View

Product Lifecycle Management

PLM has been presented as a critical architecture thread. This section presents a detailed view, using the architecture, of why PLM is a key business process that flows across all domains. Figure 8.4 is a detailed business process thread that is extracted from the architecture.

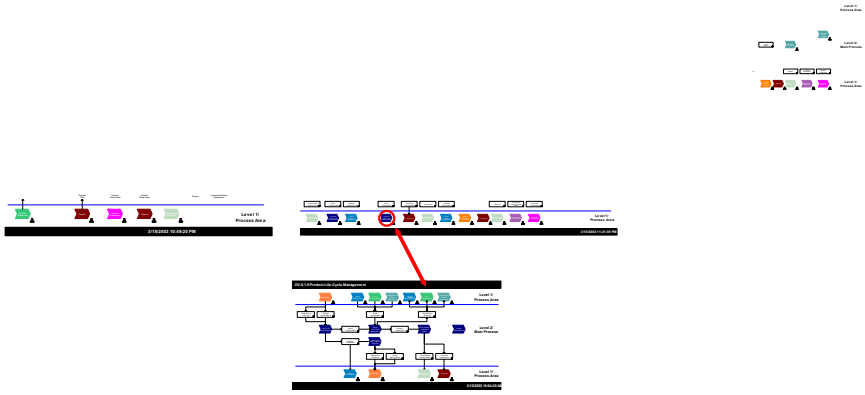


Figure 8.4: PLM Interactions on the Single Army Enterprise Value Chain

The PLM business process objects as implemented in SAP are connected with the red arcs. These objects are executed as part of the integrated SAP solution, and they flow across all levels of the architecture. A particular process flow is depicted in Figure 8.5.

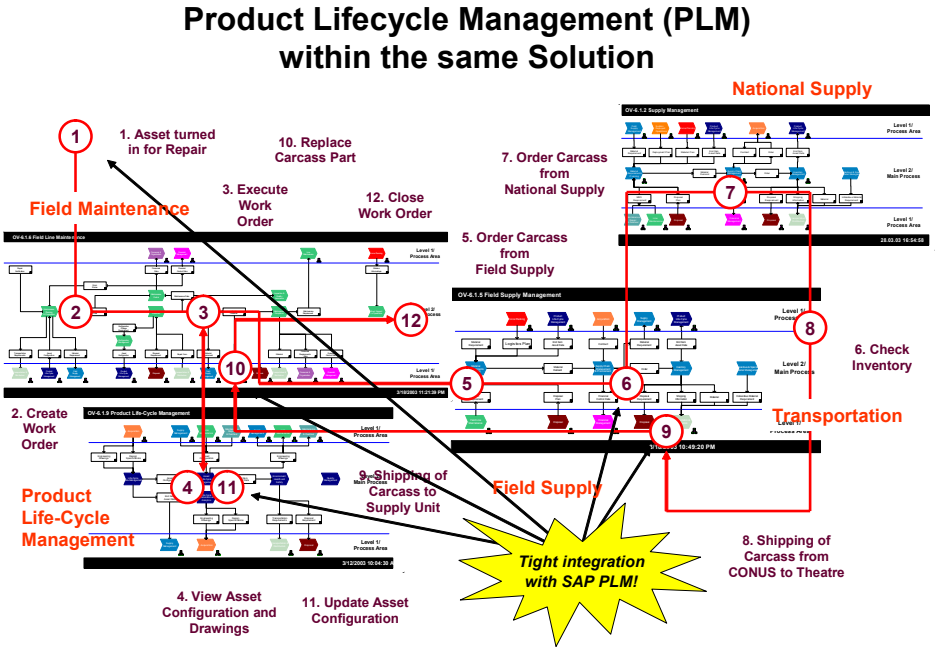


Figure 8.5: Process Flow of National and Field Army PLM

The configurations for the field and national Army solutions must be completely aligned in order to properly manage these complex business interactions. Our experience indicates that independent project structures will not support the type of coordination that is required. A higher level governing body must manage the Army logistics solution or PLM alignment will not be realized.

Product Data Management and ePDM

Figure 8.4 does not indicate the interaction with the OEM where product data is created. However, the completed architecture will include the OEM interface. This is a complex collaborative interface, which we are proposing to be managed by SAP technologies[11]. Since most product data is created through the collaborative interface between the OEM and the weapon system program office, most PLM access through the remainder of the value chain is view-only. Still, the solution is end-to-end across all levels of the enterprise, and since there is a need for the Army to maintain a technical data repository, a PDM repository is required.

The PDM repository must be completely aligned with ERP, since the PLM business process us[illegible]the technical data that is stored in this repository. A separate and independen[illegible]DM initiative could not meet these alignment requirements. The technical data must be stored in a central repository, and it must be shared across the national and field levels of the Army, and it must also be sharable with external constituents, such as DLA and the OEMs. Our solution, as presented in the system architecture description,

[11] This interface is discussed in detail in the system architecture chapter.

calls for PLM to be managed from a central NetWeaver/MDM solution, where all technical data is centrally managed. This means that the national Army solution will receive and manage all technical data that is received from the OEMs, including as-designed, as-manufactured, and as-maintained BoMs. The PLM/NetWeaver/MDM solution is the single point of entry for all technical data that is received from OEMs, and this technical data is passed to LMP and GCSS-A through the optimized SAP-to-SAP messaging capabilities that are provided in the NetWeaver solution. This "brokering" of technical data as needed is our concept of the "National Product Data Broker."

National Product Data Broker

The Army weapon system program office contains many disparate collection points for technical data. For example, the M1 tank has separate program offices for the tube, radio, engine, etc. This means that there is a need to manage and broker standardized technical across the national and field Army SAP solutions. There is also a need to share this technical data with other external constituents, such as DLA. Our system architecture enables such a brokering relationship.

Business Process Visibility

ARMY TOTAL ASSET VISIBILITY (ATAV) is a capability to help the Army and DoD better manage its assets. ATAV is an automated capability designed to provide total visibility over Army assets and the strategic decision making for many Army logistics functions, echelons, and actions. ATAV provides a single authoritative source of asset information in support of managers/decision makers. When a user submits a query to ATAV it assimilates data from as many data sources and/or resident databases as necessary to provide the user with a correct and complete response. ATAV uses data from existing sources of force structure, weapon systems, cataloging, and asset data.

ATAV provides its users with the following categories of information:

- **Assets** - shown by on-hand quantity, due-in quantity, due-out quantity, substitute quantity, condition, ownership/purpose, and project.
- **Force Structure** - on-line query capability into the Army force composition down to company level.
- **Authorizations** - Required and authorized quantities for major items and requirements objectives at the retail level for repair parts.
- **Item Information** - On-line cataloging information for the Army Master Data File (AMDF) and SB 700-20 and the Federal Logistics Information system (FLIS) database maintained by the Defense Services Center (DLSC).
- **In-transits** - Displayed by document number, stock number, Department of Defense Activity Address Code (DODAAC), voyage number, flight number, Transportation Control Number (TCN) and Radio Frequency (RF) Tag.
- **Weapon System** - Items are first configured to the major item weapon system of which they are a part or which they support. They are identified as principal prime, prime, component major item, associated support item of equipment, or munitions. Indentured relationships are then shown both "bottoms-up" and "top-down". "Top-down" shows end items broken down to progressively lower major item subassemblies showing their individual piece parts; that is, end items broken down to nuts, bolts, and washers. "Bottoms-up" displays all end item applications a piece part is used on.

ATAV falls short in one key area – the system will tell you where and who has the asset and if it's in-transit, but it will not enable control processes for managing events within and between organization in the US Army value chain. Business Process Visibility will allow the US Army to monitor the value chain processes, provide visibility within the process and alerting appropriate parties of potential critical situations and is the foundation for an adaptive value chain. By actively notifying the responsible persons and making them aware of critical situations or exceptions, the process participants can optimize reaction times and improve quality and customer satisfaction.

This information can then be used to evaluate Key Performance Indicators (KPIs) and/or indicators that measure collaboration between partners (CPIs). KPIs measure the extent to which the US Army Logistics targets have been met, whereas CPIs help to determine the reasons why targets have not been met. An example of a target would be improving the overall lead-time. This is measured using the Overall Lead Time KPI. You can use the Transportation Service Provider Reliability CPI to find out why the target was not met.

SAP's Event Manager is the cornerstone of the Business Process Visibility solution. The Event Management is capable of processing several different types of events. Within a given process, you will have events that are expected to happen events that actually happen. From a performance perspective, it is desirable to compare the actual event against what you expected.

- The first type of event is an event that is expected to happen within a particular time frame and it happens as expected. That is a regular event.
- A second type of event is an event that is expect to happen within a particular time frame and it happens outside the expected time frame. This is an overdue event. An overdue event can cause a subsequent event to be rescheduled, or it could just be recorded as an overdue event.
- A third type of event that could occur is one that is unexpected. This could be, for example, where a transportation vehicle breaks down en-route – something that could potentially have an affect on subsequent events and something needs to be rescheduled or another action needs to be taken because of this unexpected event. An unexpected event could trigger an alert or other type of notification.
- The fourth type of event is an unreported event. In this case, you expect an event to occur within a particular time frame, but it for whatever reason, it is not reported. It is possible that something still needs to happen following this event so you could set a time limit that sends a message or causes something to happen when the event is unreported in a certain time period.

These events are depicted in Figure 8.6.

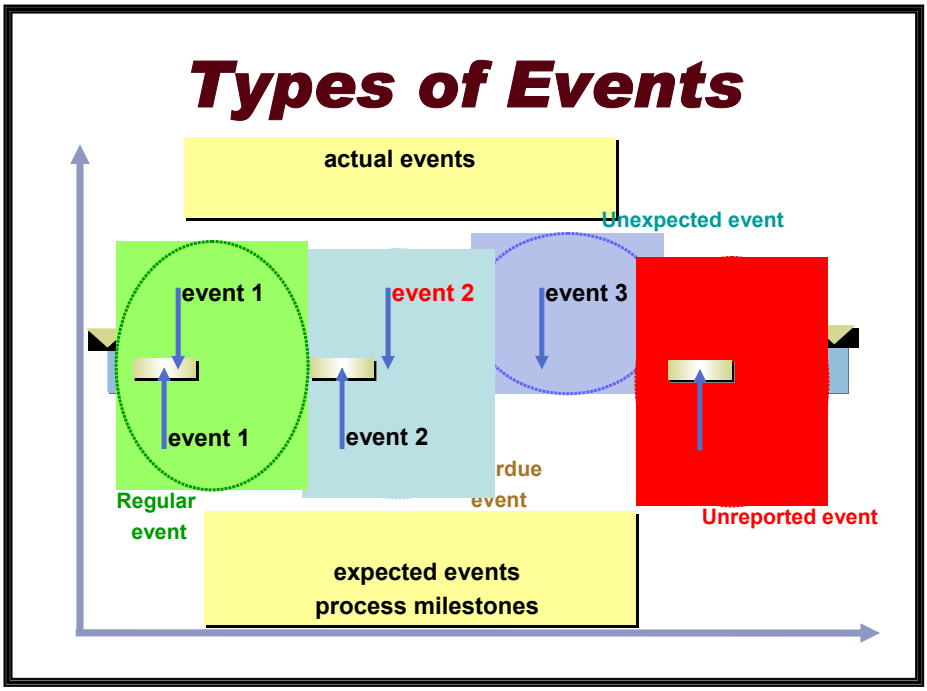


Figure 8.6 Types of Events

It is particularly useful to track events that:

- Contain information about the process status and progress
- Are required for documenting for contractual (e.g. service level agreement) or legal (e.g. shipment of dangerous goods) purposes
- Need to be proactively monitored as milestones
- Are used to send messages to those involved
- Require or trigger further action or trigger

There are many ways to communicate the actual events to SAP's Event Manager. Possible communication scenarios include updating with an online transaction, EDI/XML connection, onboard devices, manual entry, offline PDA's, voice recognition, login with a web interface, or updating using AIT & RFID. A review of these options is depicted in Figure 8.7.

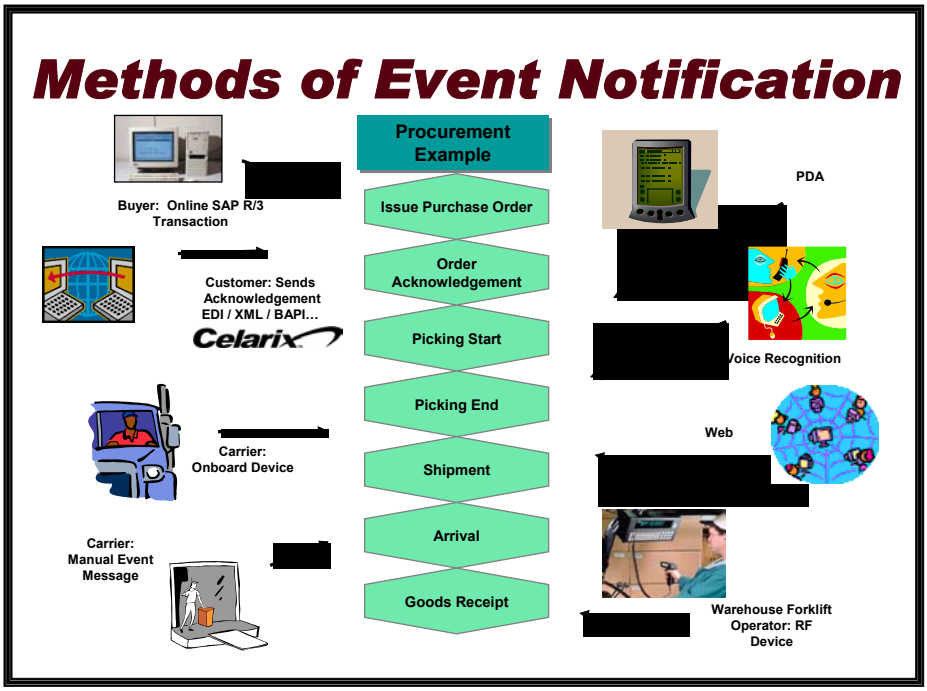


Figure 8.7: Method of Event Notification

Status on the business process is retrieved based on the role of the user and is accessed through a WEB front-end, as depicted in Figure 8.8.

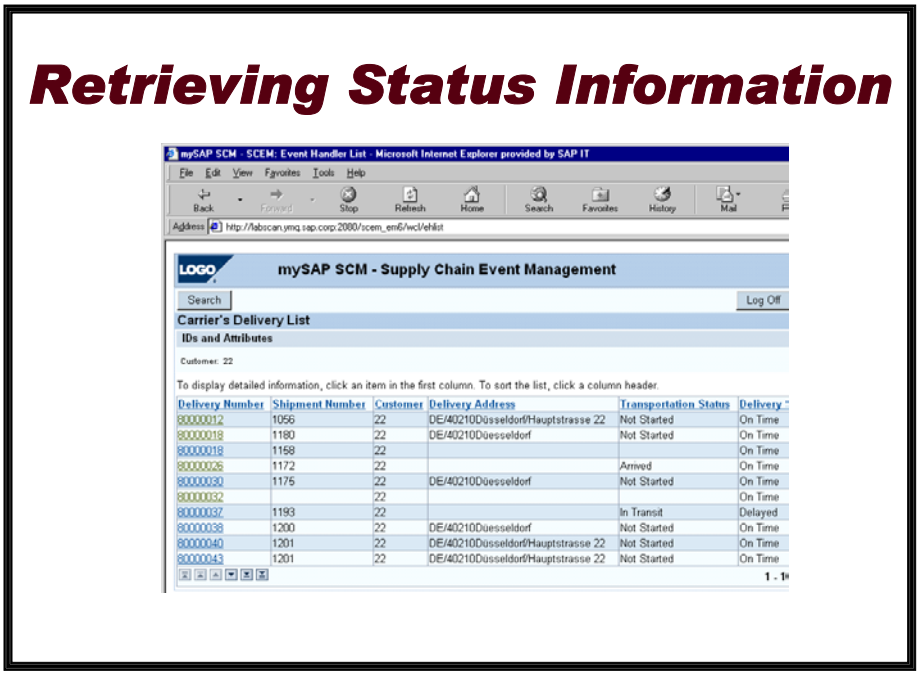


Figure 8.8: Retrieving Status Information

The event information that the event manager collects becomes the basis for determining how well the value chain is performing. The information is stored and managed within the Business Warehouse. The performance management system stores best practices information such as those developed by the SCOR model to monitor how well internal organization or cross-organizational processes are performing. In near real time, US Army Logistics Leadership can see how well the value chain is performing compared to statistical averages or predetermined metrics and make adjustments to their performance as required. The analytic presentation process is depicted in Figure 8.9.

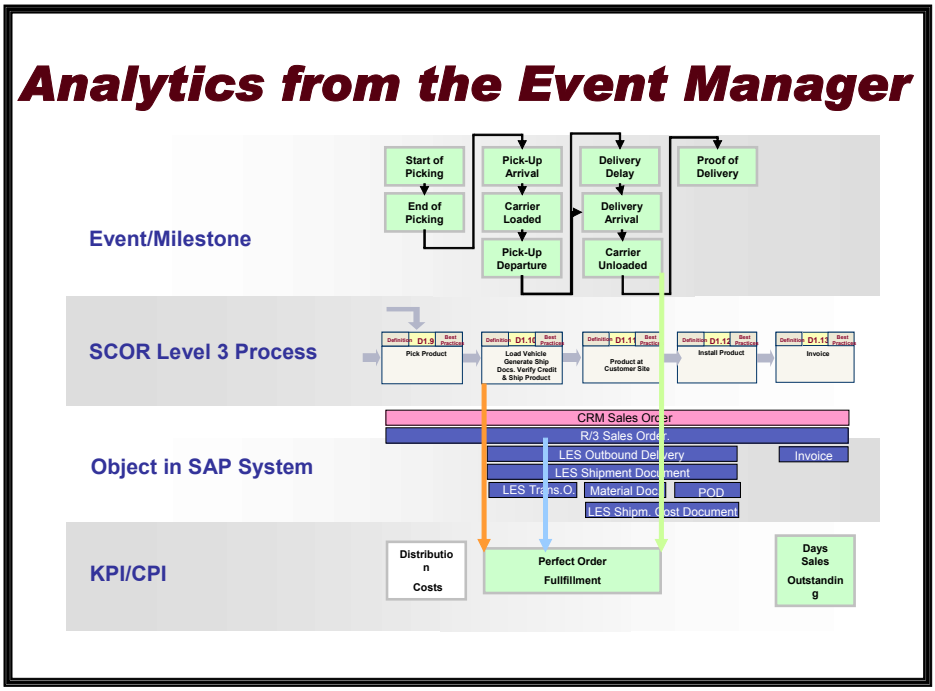


Figure 8.9 Analytics from the Event Manager

The benefits of Business Process Visibility include:

- **Reduced inventory levels**, due to greater predictability, reduced uncertainty, longer lead times, and improved control – all of which stem from being able to see the value chain network all the way to the final customer.
- **Increased adaptability** with the ability to respond quickly in changing operational environments; identify the best alternatives when unplanned events occur; and keep the entire value chain network ahead of changing operational requirements.
- **Increased customer satisfaction**, through shorter lead times, improved service, and the ability to provide end-customers with accurate updates and commitments.
- **Reduced costs**, through the ability to deploy resources where they can be most effective in handling demand; the reduced need for operational firefighting; and decreases in expedited delivery costs.
- **Enhanced operating efficiency**, from downtime reduction, workload leveling, and proactive response to plan breakdowns.
- **Increased responsiveness and operating velocity**, due to the ability to manage inventory, processes, and network design – not just the movement of goods.

Integrated Data Environment

The IDE is an Enterprise Application Integration (EAI) entry point into DLA. Versions 1.1 and 1.2 of the IDE are prototype demonstrations. Version 2.0 is a production version and does not include all log functionality. Version 3.0 will be a production version and will include all log functionality. Since the Army architecture is focused on implementation, versions 2.0 and 3.0 are critical to the Army. The documents associated with version 2.0 are procurement sensitive, so a complete architecting of the Army relative to the IDE is impossible at this time; e.g., at the operational level inclusion in the Army architecture requires an understanding of:

- The business processes that are enabled by Versions 2.0 and 3.0,
- The technical standards that are supported by Versions 2.0 and 3.0, and
- The estimated implementation schedules for Versions 2.0 and 3.0.

However, we can demonstrate that the Army architecture is aligned with the vision of the IDE, as we understand it from the documentation that we have been provided.

IDE Concept

The objective of the IDE is to "provide an enhanced environment that enables the DoD Logistics Enterprise to execute practices, processes, applications and decision support tools to achieve logistics interoperability and allow for information exchange within and between internal and external DoD business partners." The vision includes:

- "Non-system dependent transactions,
- Consolidation and reuse of interfaces,
- Data integration/sharing, and
- Leverage modernization efforts."

The IDE architecture is based on the CrossWorlds architecture as reproduced in Figure 8.10.

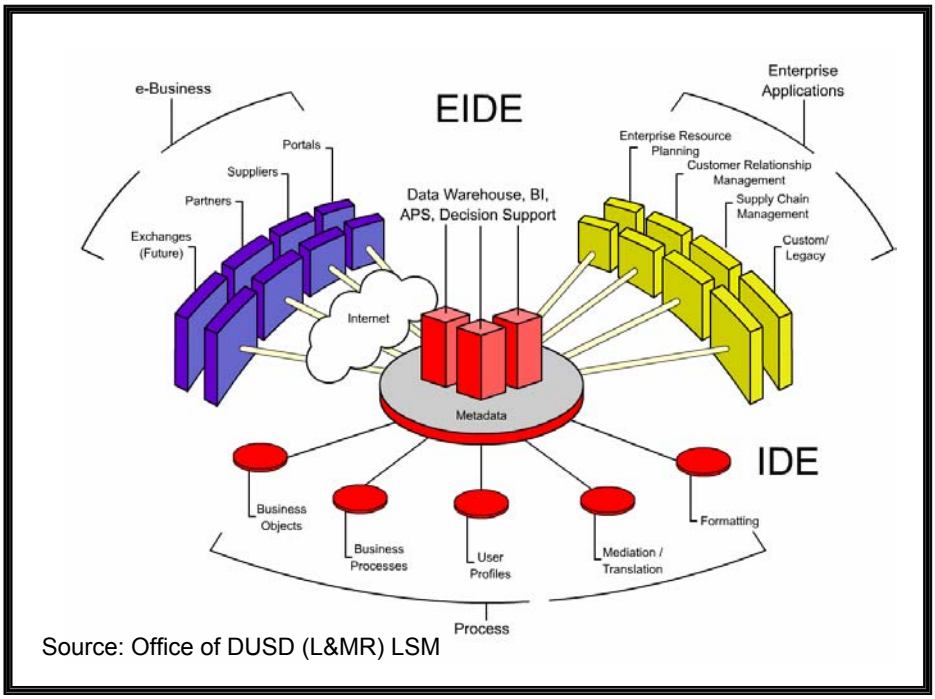


Figure 8.10: The Enterprise Integrated Data Environment

The IDE, when fully implemented by DLA, will extend the core EAI technologies from WebMethods to include:

- An enabler for collaboration,
- Support directory services,
- ePortal services,
- Security services, and
- EDC/ETN services.

The IDE will be the single point of entry to the DLA SAP solution for Business Systems Modernization. The vision for the DLA Transformation and IDE is presented in Figure 8.11.

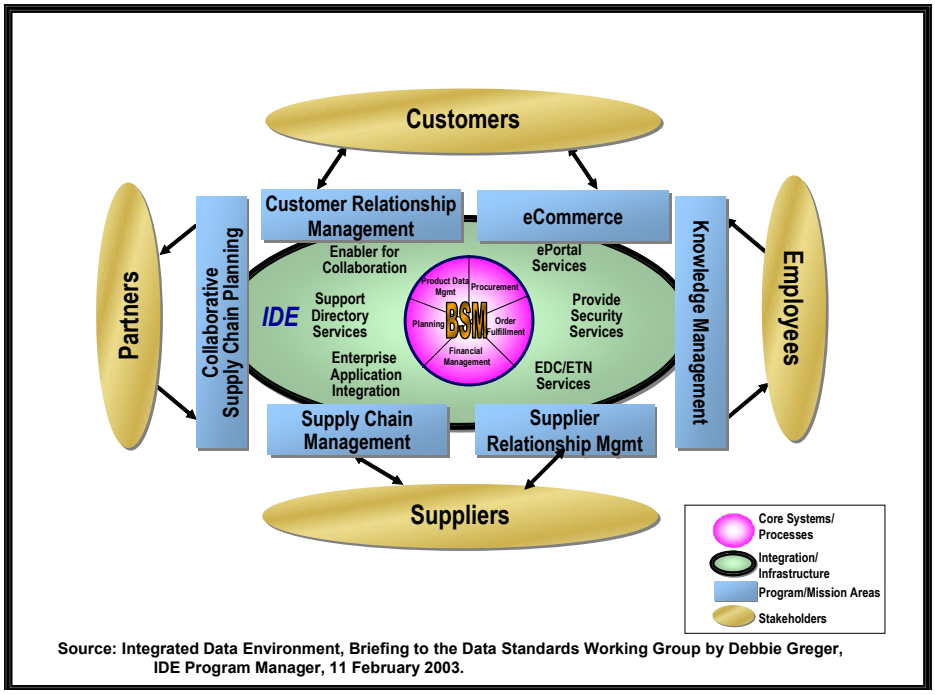


Figure 8.11: The DLA Transformation and IDE

The DLA vision and the Enterprise IDE architecture align completely with the Army's Single Logistics Enterprise Architecture. This is demonstrated in the following section.

The IDE and the Single Army Logistics Enterprise

The IDE provides a single point of entry for the Defense Logistics Agency, and the Army's PLM+ hub provides a single point of entry for the Army. Hence, there is potential for a single point of entry between the Army and DLA, greatly reducing the number of interface points across the organization. Furthermore, since the IDE uses WebMethods technologies, and since the Army's PLM+ hub uses WebMethods technologies, the alignment of the two hubs is simplified[12]. In effect, the current architecture supports one set of connectors from PLM+ to the IDE. We do not have an accurate count of how many interfaces would be eliminated, but the number would be significant.

A high level architectural concept for the interaction between PLM+ and the DLA IDE is presented in Figure 8.12.

[12] It is interesting to note that the potential is present for "optimal messaging across DLA and the Army. The Army's PLM+ hub uses SAP NetWeaver technologies, which is optimized for messaging across SAP components. BSM is an SAP implementation, but the IDE does not consider optimized SAP messaging with the outside world. If the BSM solution were extended to include NetWeaver, true integration across the Army and DLA could be obtained.

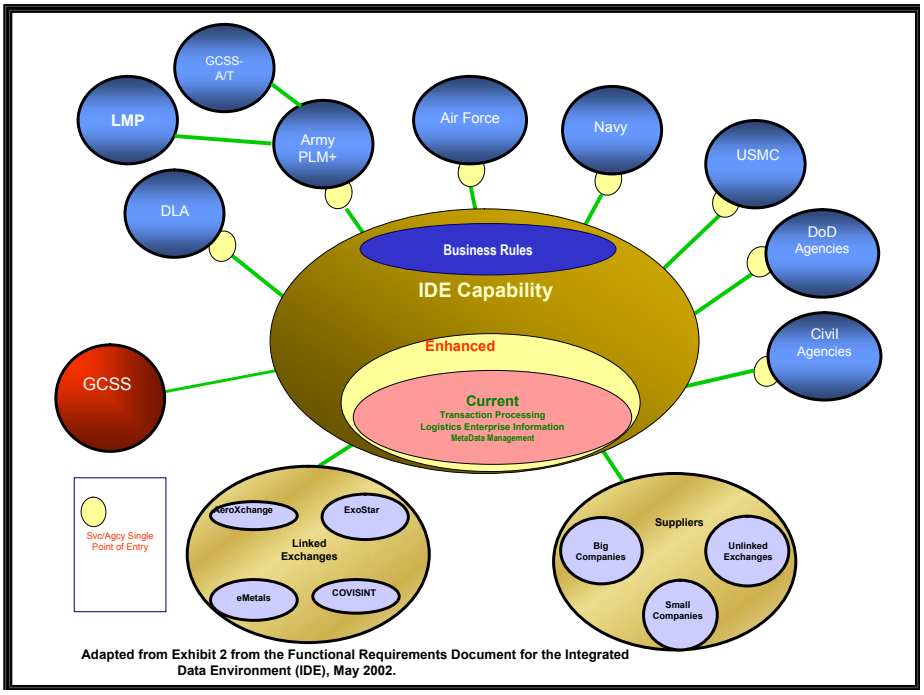


Figure 8.12: IDE Top-Level Operational Architecture (Modified to Include Army Detail)

Exhibit 2 in The Functional Requirements Document for the Integrated Data Environment (IDE) indicates the Army as one input into the IDE. The above figure is a modification of the IDE Top Level Architecture to indicate how the Army Single Logistics Enterprise Architecture aligns with the IDE Top-Level Operational Architecture. The IDE is a single point of entry for the DoD enterprise, and Army PLM+ is the single point of entry for the Army. In effect, PLM+ is the IDE for the Army.

Aligning the Army with the IDE

The precise alignment with the IDE is uncertain at this time. Since PLM+ and the IDE are still concepts as opposed to production systems, alignment can only be approximate. For this document, we use the IDE schedule that was presented to the Data Standards Working Group on 11 February 2003. This schedule is reproduced as Figure 8.13.

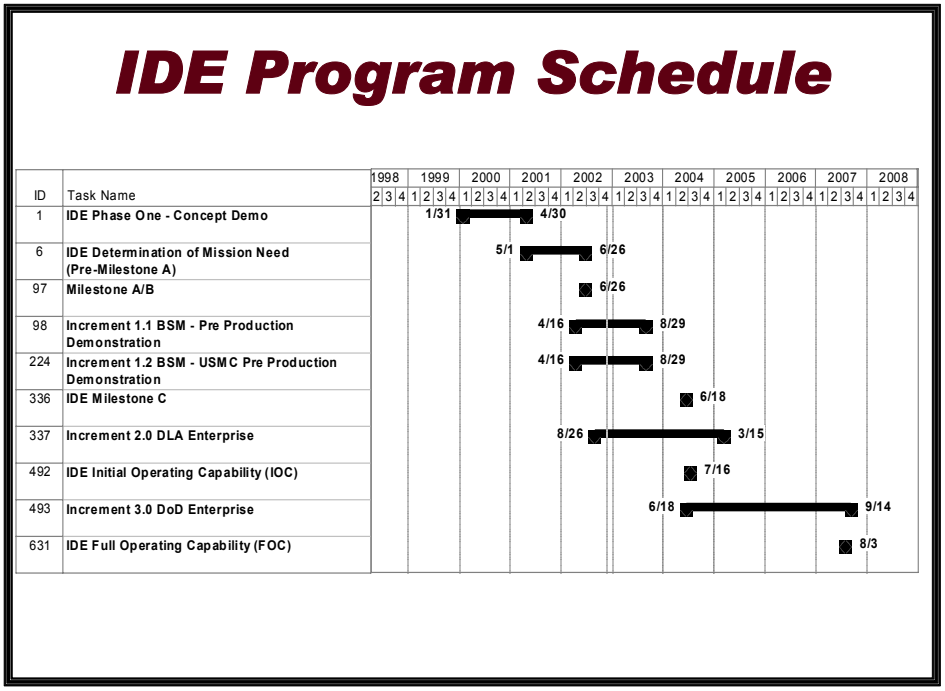


Figure 8.13: IDE Program Schedule[13]

For the Army, the critical date is August 2007, which is the date of full Logistics capability for the IDE. The Army's PLM+ hub must be aligned with this schedule. This schedule is discussed in the Integrated Schedule section of this report.

Management of Technical Documentation

This section describes how the architecture prescribes for the management of technical documentation for weapon systems and other critical assets. This is composed of two parts:

- Enterprise Document Management and Publishing (EDM), and
- The delivery of technical documentation as Interactive Electronic Technical Manuals and other formats.

Accenture has defined this package as Service Data Management: "Service Data Management is the creation, storage, retrieval, update and distribution of information relative to the operation and/or maintenance of high-value complex assets." Accenture has provided a conceptual Solution Blueprint for Service Data Management[14], and our team was asked to ensure that the Army architecture is compatible with that vision. As will be demonstrated, the Army architecture meets the requirements of Service Data Management, and leverages the concept by providing a fully integrated (as opposed to interfaced) Service Data Management Solution.

[13] This schedule was taken from Integrated Data Environment, Briefing to the Data Standards Working Group by Debbie Greger, IDE Program Manager, 11 February 2003.
[14] Accenture LLP, Service Data Management Analysis: Conceptual Blueprint Solution, 14 February 2002.

The Service Data Management Concept

The Accenture functional concept is presented in Figure 8.14.

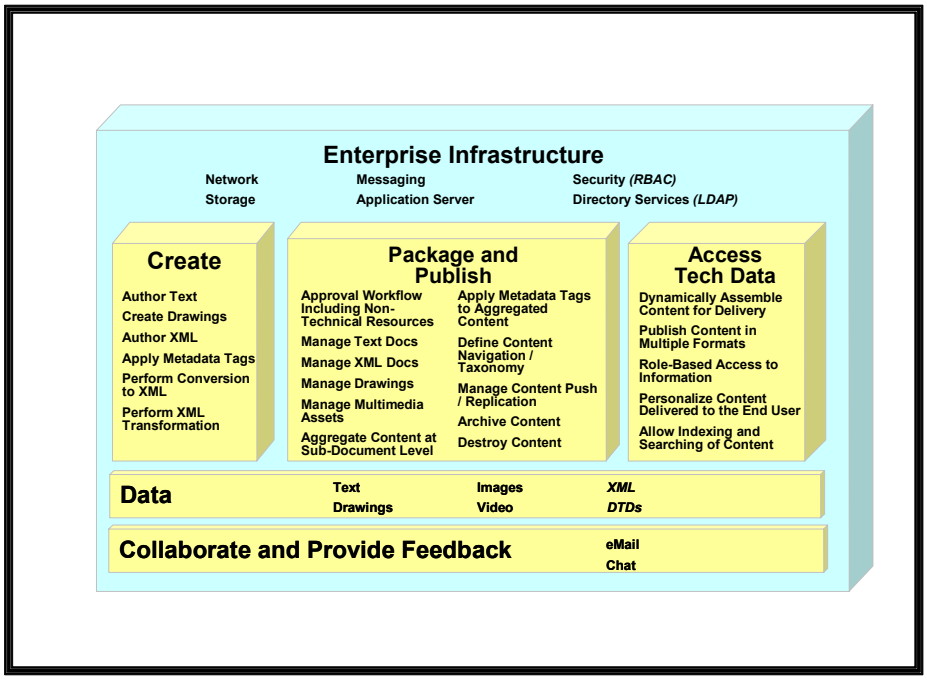


Figure 8.14: Service Data Management Functional Concept

Accenture does not recommend a solution per se, but demonstrates that "any number of products can be used in combination to realize the unforeseen benefits." This collection of product approach is presented in Figure 8.15[15].

[15] This is a reproduction of Figure 7 from the Accenture Conceptual Solution Blueprint.

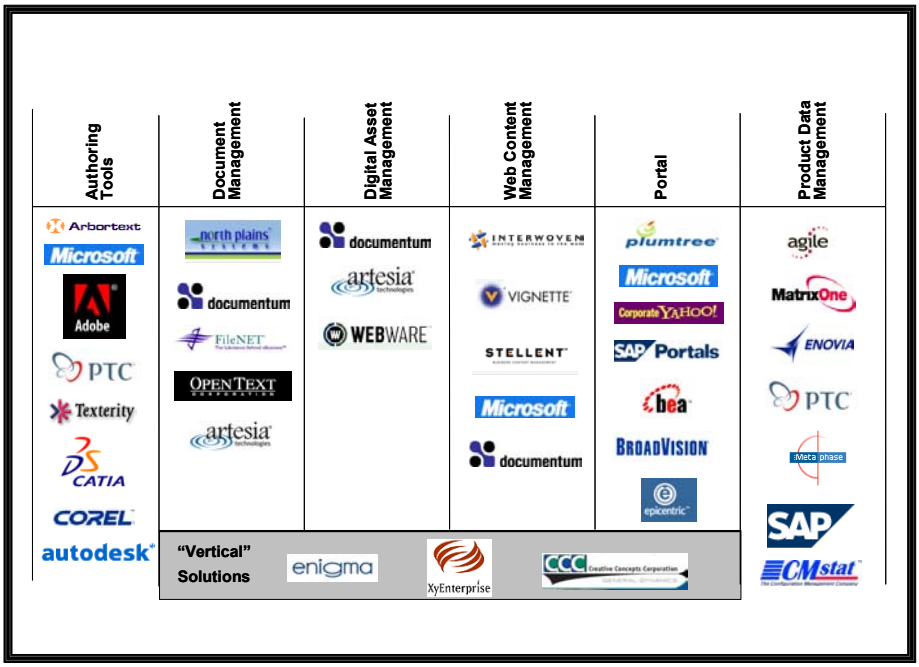


Figure 8.15: Service Data Management Sample COTS Products Per Category

Accenture does not align products specifically with a systems architecture, since that was not their intent. However, a generic system architecture is presented. This architecture is reproduced as Figure 8.16.

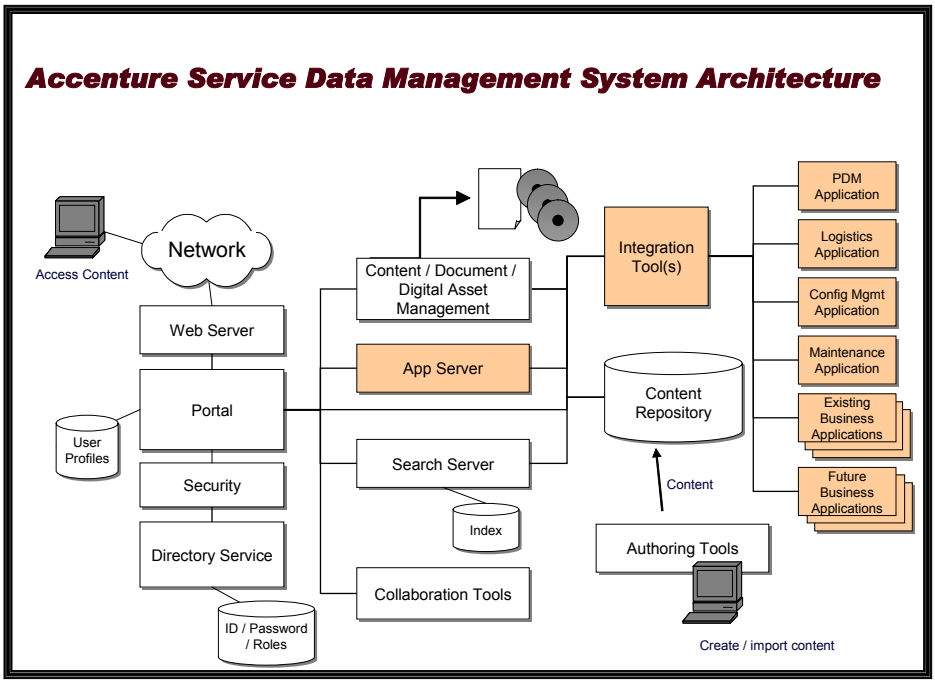


Figure 8.16: Accenture Service Data Management Architecture

While this architecture could be implemented with any number of products as suggested by Accenture, the U.S. Army prefers to preserve the integration domain. That is, a collection of COTS products would have to be interfaced to SAP, and furthermore, critical master and transactional data would have to be constantly reconciled in order to maintain integrity across all of the components. The Army solution adheres to the Accenture requirements, but eliminates the interfaces. Furthermore, by staying inside the integration domain, all technical data, including product data and service data, is retained in the same integration domain. This means that all relevant data is instantaneously available without passing through disparate application program interfaces. The Army's concept is presented in Figure 8.17.

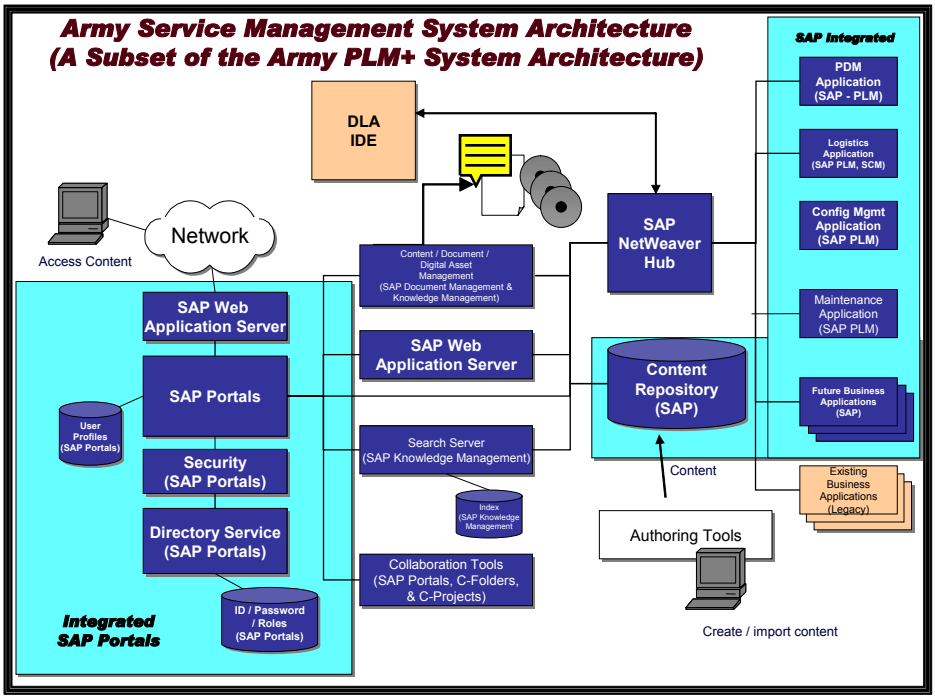


Figure 8.17: Army Service Data Management System Architecture

This architecuture meets the functional concept of Figure 8.14, and it also aligns perfectly with the system concept in Figure 8.16. Furthermore, all "back-office" applications are integrated, as indicated in the right panel of Figure 8.17, labeled "SAP Integrated." All customer-facing applications are also included in SAP, as indicated in the left panel of Figure 8.17, labeled "Integrated SAP Portals." This preserves the integration domain and minimizes interfacing.

The Army Single Logistics Architecture meets the requirements of the Accenture Service Data Management Conceptual Blueprint, but the Accenture concept is extended in the Army Architecture in a powerful way. The Army architecture preserves the integration integrity of the SAP software, making all relevant data instantaneously available without having to pass through disparate application program interfaces. This allows the Army to minimize interfaces while maintaining all technical data (service and product) within a single authoritative data source.

Relationship to Total Lifecycle Systems Management

Figure 8.3 a direct representation of how TLCSM will be implemented by the Army. This architectural structure will be aligned with TLCSM as it is defined in the FLE/FMEA architecture.

Performance Based Logistics in the Architecture

Performance Based Logistics

Performance Based Logistics (PBL) is a strategy for buying weapon system support as an integrated package. PBL requires that the government establish a service-based contract defines specific performance goals that are met by the service provider. These agreements establish clear lines of authority and responsibility for both the service provider and the government. Under PBL, the weapons system Program Manager is the life cycle system manager, responsible for cradle to grave management.

PBL and New Weapon Systems

PBL presents new challenges, since the DoD does not have a track record of successful services contracting. This is a serious issue that should be given due attention, since the private sector also has a mixed history of outsourcing core processes through service contracting or otherwise.

Some commodities and legacy weapon systems may not lend themselves to the FCS sustainment model. For those items, the National Asset Manager (NAM) should own the materiel, regardless of where it is positioned or its condition code. More importantly, the NAM should also collaborate with the installation managers on the range and depth of items that are forward positioned to optimize support to the entire Army.

The Army cannot permit the units to determine inventory levels using different sets of expectations and criteria. In order for the NAM and the customers/unit to have confidence in the new business processes, the NAM must have accurate inventory records for making buy & repair decisions, positioning decisions, and repositioning decisions. Everyone should have access to appropriate information, but only the NAM should have access control. The Army cannot afford to have NAMs spending 55% of their time trying to reconcile asset/inventory data being reported from multiple locations using multiple systems. Even if the interfaces are efficient, the information will be wrong most of the time due to interface or synchronization errors.

Architectural Implementation of PBL

The Army Performance Based Logistics (PBL) Army Implementation Guidebook (U.S. Army, May 2002) addresses the acquisition aspects of PBL. These acquisition aspects map to the architecture as seen in Figure 8.18.

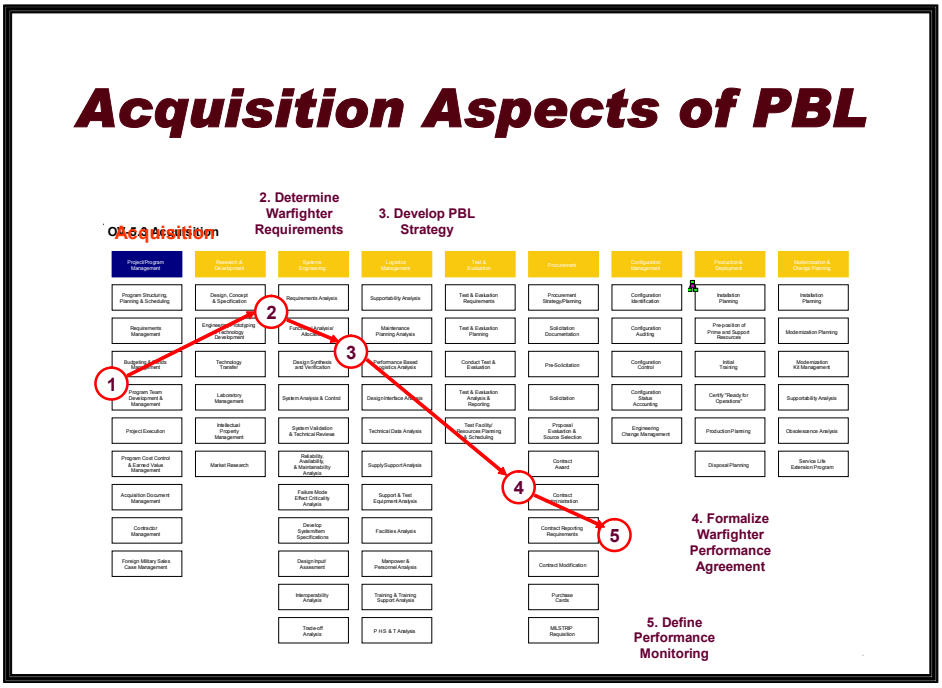


Figure 8.18: Performance Based Logistics in the Architecture

To implement PBL the Program Manager (PM) is required to establish a PBL team. This team must be able to collaborate across stovepiped organizational boundaries. The Single Army Logistics Architecture demonstrates how this inter-organizational collaboration should occur.

Next, the PM consults with the customer (i.e., the warfighters) to determine the customer's requirements, which drive the PBL strategy. Many PBL strategies exist, ranging from work executed entirely by the government, entirely by the private sector, or jointly in public-private partnership. The performance agreements (with warfighter definition) are documented as a contractual requirement. On the system side, these agreements are monitored using the agreed performance metrics. The performance metrics are the key element in Performance based Logistics.

Performance Monitoring

The formalized performance agreement with the warfighter provides the objectives that form the basis of the PBL effort. A focus on a few outcomes measures – such as weapon system availability, mission reliability, logistics footprint and overall system readiness levels- leads to more effective solutions. The next task for the PM is to measure how well the objectives are being achieved. The PM develops measures of readiness and supportability performance that are balanced against costs and schedules.

Linking metrics to existing warfighter measures of performance and reporting inside the system is the key for automated monitoring. Many logistics and financial metrics can be related to top-level warfighter performance outcomes; e.g., requisition fulfillment rate, customer wait time, ratio of supply chain cost to sale, and maintenance repair turnaround time,. In structuring the metrics and evaluating performance, it is important to delineate any factors that could affect performance but are outside the control of the PBL providers.

Figure 8.19 shows how the PM identifies functions for collecting measures within the logistics value chain. The measures defined by the PM are directly pulled from the operation of supply and maintenance in all levels of the architecture.

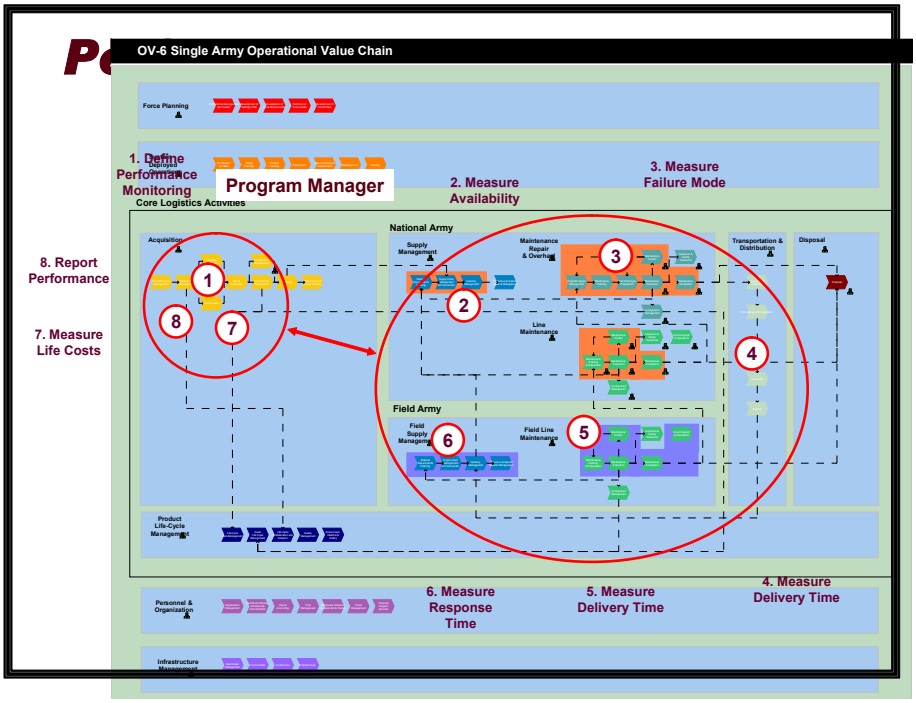


Figure 8.19: Performance Monitoring with PBL

Systems View of PBL

Our Architecture defines a Single Army Logistics solution. All required information to allow performance monitoring is contained in the integration domain. As shown in Figure 8.20, all operational information is integrated in the Master Data Management solution[16]. The

[16] See the discussion in this document about the SAP Master Data Management solution.

Business Warehouse (BW) defines the agreed warfighter measures and allows flexible reporting to enable the PM to evaluate the contractual performance agreements. The associated data collection is automatic, with all performance monitoring metrics pulled directly from SAP.

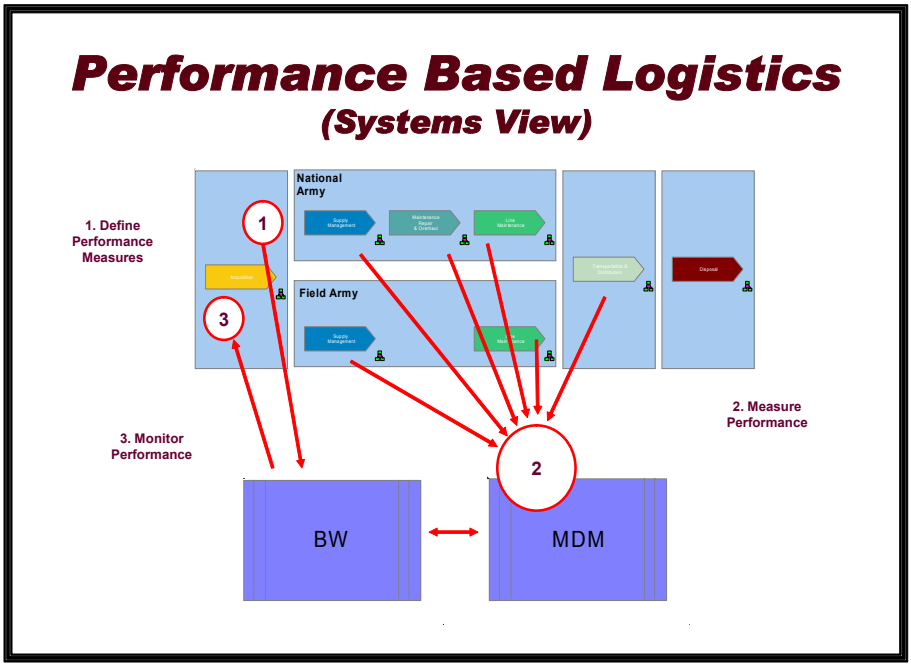


Figure 8.20: Systems View of Performance Based Logistics

Relationship to End-to-End Customer Support

The End-to-End Customer Support[17] effort is one of the six Deputy Under Secretary of Defense for Logistics and Materiel Readiness' Future Logistics Enterprise Initiatives. The goal of End-to-End Customer Support is an integrated, synchronized, End-to-End Distribution system to meet warfighter requirements for information and materiel. End-to-End Customer Support provides materiel, including retrograde, and associated information from the source of supply to the point of use or disposal as defined by the Commander-in-Chief, Military Service, or characteristics of the commodity, on a worldwide basis. It includes influencing acquisition, sourcing, positioning, and transportation to facilitate the flow of materiel to the end user.

End-to-End Customer Support recognizes that the deployment process and distribution process need to be synchronized. Current distribution processes are fragmented and supported by numerous information systems, and the Department is moving increasingly towards a variety of commercial logistics arrangements that will further increase the number of separate supply chains delivering materiel to the customer. Full implementation

[17] This initiative was formerly known as End-to-End Distribution.

of the E2E initiative is projected to dramatically improve supply chain decisions on the positioning, movement and delivery of materiel by establishing a single focal point responsible for optimizing the distribution process and ensuring accountability for customer service. A Collaborative Working Group consisting of representatives from the Military Services, Joint Staff, USTRANSCOM, DLA, and Joint Forces Command, has been formed to work the End-to-End Customer Service issues.

Progress has been made, but our research indicates that this initiative in not well defined, and it is not well understood by the components or the agencies. The concept is aligned closely with private sector Global Logistics models, but full implementation requires significant business process integration across DLA, the Components, and TRANSCOM. This business process integration must be supported by integrated systems for the benefits of E2E to be fully realized. There is hope, since the Navy, Army, and DLA are all using the same standard software solution, but significant additional integration across organizations is required before this initiative is fully implemented.

The 6 March 2003 memorandum from the DUSD (L&MR) requests that the components generate plans for implementing E2E Customer Support, but the focus of the memorandum is not on business processes or integration, but on performance based contracting. This does not provide architectural guidance, but it is related to other issues that are addressed by the architecture. For example, the comments about Performance Based Logistics that are presented in another section of this document apply to performance based contracting for transportation/distribution services as well.

Key policy changes for defining E2E Customer Support are scheduled for Summer, 2003. It is anticipated that the policy changes will focus on shifting and realigning roles and responsibilities for E2E Customer Support. One vision of E2E Customer Support is presented in Figure 8.21.

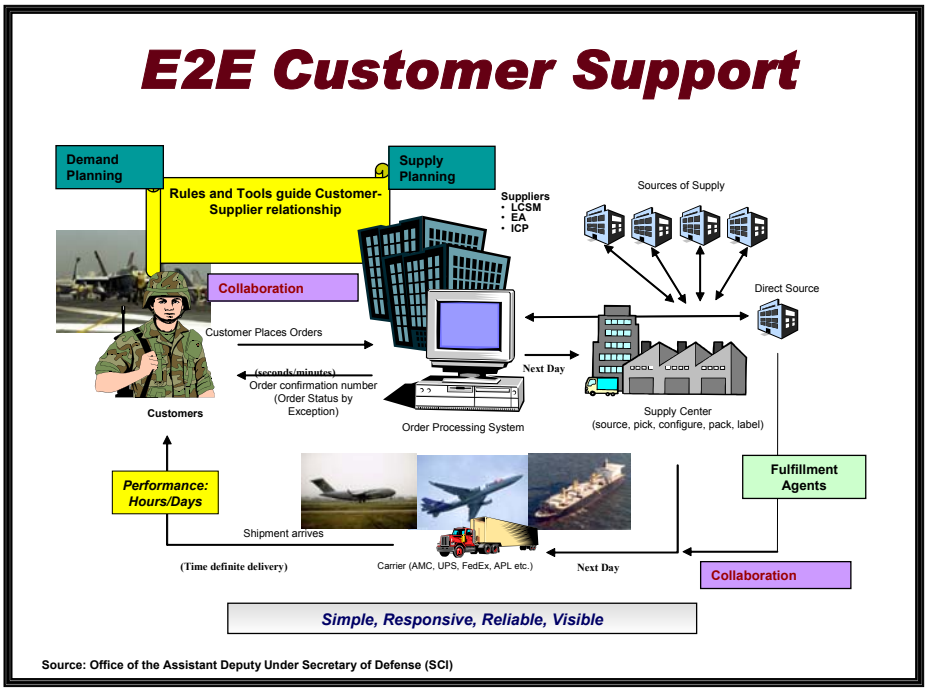


Figure 8.21: A Vision for E2E Customer Support

E2E Customer Support and the U.S. Army

Here is our understanding of how E2E Customer Support will be implemented in the U.S. Army:

- TRANSCOM executes a transportation contract, and DLA executes the contract delivery orders.
- DLA owns the forward warehouse.
- The end of end-to-end is the "point of accountable receipt."
- Class 7 parts are shipped directly to the foxhole with the PM responsible for delivery.
- The analogy for E2E is the e-Commerce Aggregator Model. The customer (e.g., the Army) purchases the transportation service from the aggregator (e.g., DLA). DLA executes a delivery order against a TRANSCOM contract, and purchases the service from a provider (e.g., UPS Logistics). The provider executes the delivery and then invoices against the TRANSCOM contract.
- In-theater distribution could be a bottleneck. If there is not way to make immediate delivery to the end point, then a priority list should be constructed, and the "log manager" controls the list.
- The end result is that the supply chain is more efficient, requiring fewer inventories. The savings from holding fewer inventories can offset the cost of purchasing cargo services from commercial carriers like Evergreen and World Airways.

Figure 8.22 provides an overview of how the Army currently relates to the distribution and transportation processes.

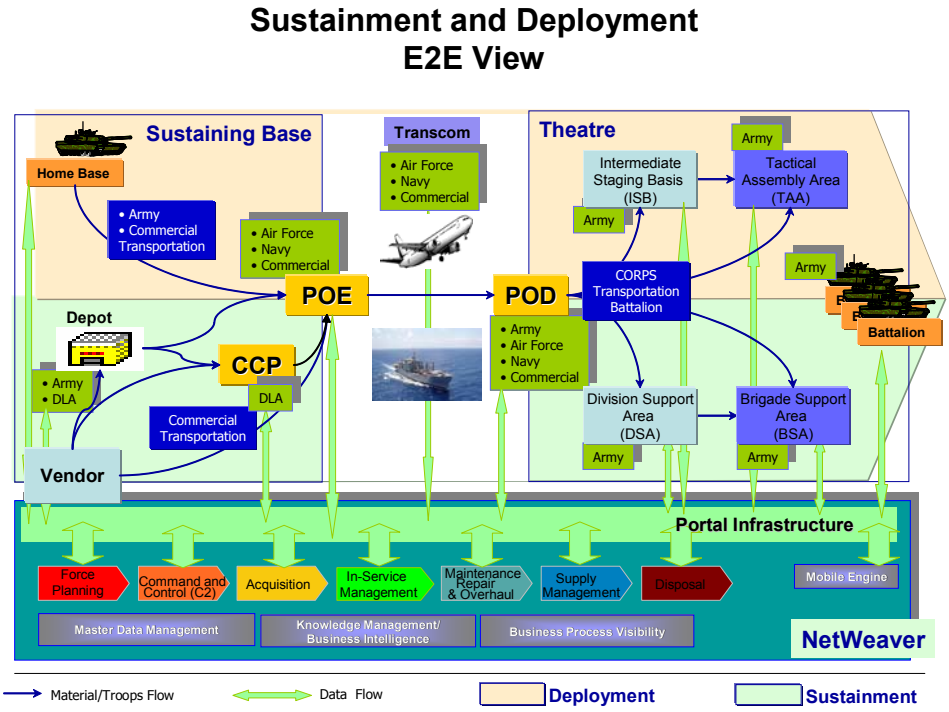


Figure 8.22: Current Army Sustainment and Deployment Processes

Figure 8.23 shows how the Army Solution enables the implementation of the E2E initiative.

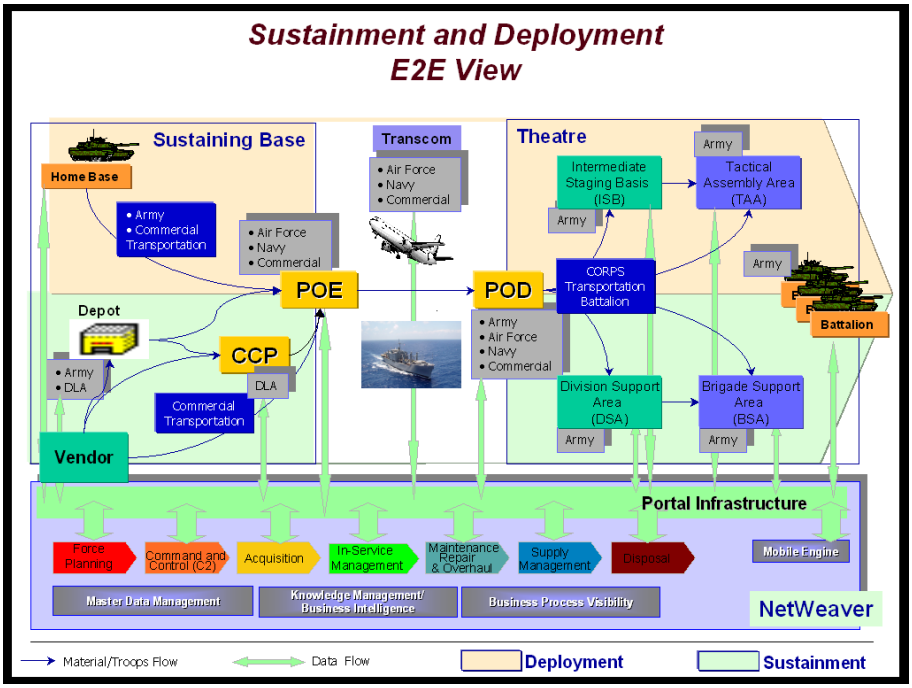


Figure 8.23: Army Sustainment and Deployment Processes with E2E Customer Support

As indicated in the above illustration, little changes in the way that materials flow. The ownership of the processes, however, is shifted. In this case, the shift is to the National Asset Manager (NAM) who negotiates service level agreements for transportation and distribution services. Our opinion is that E2E Customer Support is more about ownership than business processes.

Industrial Base Modernization

The National TLCSM value chain contains all aspects of National sustainment, to include all "fixed" maintenance activities. If an activity is deployed (or has the potential to be deployed), then it is not "fixed." This distinction is important, since all fixed maintenance activities should be included in the National value chain, and the deployable activities in the Field value chain. This distinction applies across the entire Army, including the Army Reserve and the National Guard. Our recommendation is that the National and Field value chains be completed in accordance with this bifurcation, extending the SAP integrated solution across these value chains. Since both value chains are dependent on the same technical data, the PLM+ solution will broker technical data to both value chains. By separating according to fixed and deployable, it is possible to standardize business processes accordingly.

Relationship to the Army Installation Management Agency (IMA)

Integrated solutions do not always align cleanly with organizational boundaries. Packaged software business processes are designed to accomplish cross functional tasks. The fact that maintenance support functions reside inside IMA organizational boundaries does not imply that they are not part of the TLCSM value chain. These maintenance activities use the same technical data and should use standardized business processes to the extent possible. The maintenance activities that are inside IMA should not use different systems and interface to the integrated solution that is proposed in this study. This splits the integration domain, creates complex Army-to-Army interfaces, and drives up cost. The distinction here is that Army-to-Army interfacing is completely controllable and avoidable.

The maintenance activities that are owned by IMA can remain in IMA, but since they received technical data from PLM+, they must be in the SAP solution domain that is defined by the Single Logistics Enterprise Architecture. The implications are not organizational in focus. The only requirement is that IMA, AMC, and the Field Army share the same integrated computer system. We are not recommending that they realign their organizational boundaries.

While we believe that the city management functions of LMP are great candidates for ERP, we make no recommendations on those business processes in this study. City management business processes were not in the scope of this study.

Data Standards

The industrial base implementation requires significant oversight and control by the Office of the DALEI. The same data standards should be applied across the National and Field value chains. Since many of these standards have already been identified and some have already been implemented in the LMP project, this project must constrain the adoption of data standards by the GCSS-A/T project. This is particularly true in the area of Automated Identification Technologies (AIT), where the LMP program has recommended a number of data standards. Some of these recommendations are summarized in Figure 8.24.

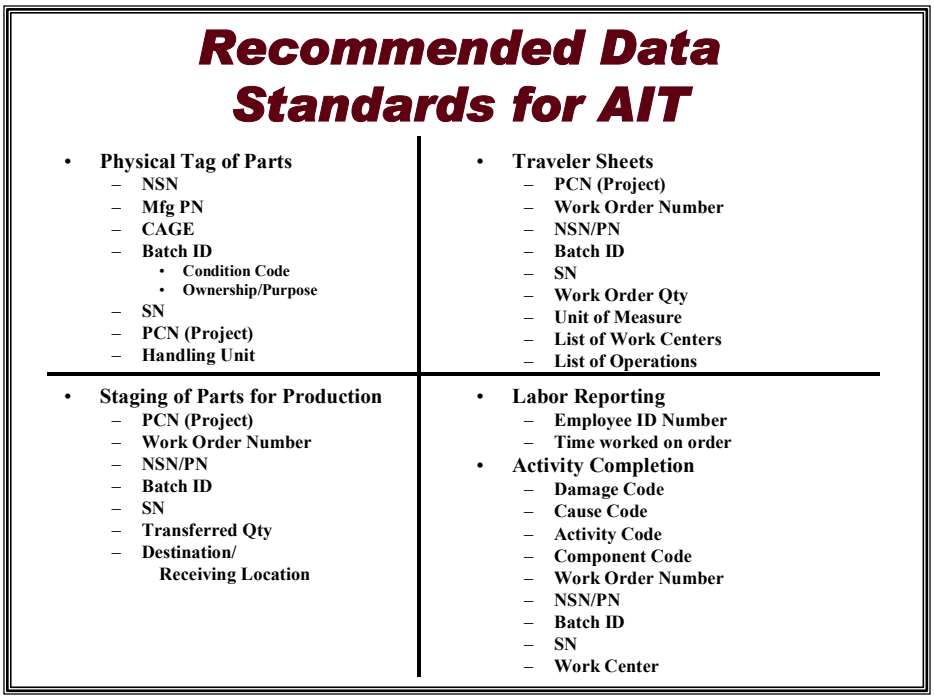


Figure 8.24: LMP Proposed Data Standards for Automated Identification Technologies

In accordance with all previous discussions, the Army must have one set of master data. Given the progress of the LMP, this program should be the baseline for the data standards that apply to other Army solutions.

Manufacturing Execution System (MES) Integration with ERP

Manufacturing Execution Systems are a species of plant-floor computer systems meant to automate production control and production process management. These standard software solutions replace both paper-based systems and the many stand-alone systems that have emerged on plant floors over the last 30-40 years. In general, the MES enables the movement of the order through the factory and onto the shipping dock. The MES is concerned with scheduling work, based on orders that are in hand, while providing realistic delivery dates to customers wanting to place orders, based on real-time information about shop floor conditions. The MES is the information system that plans shop floor resources (e.g., people, equipment, and controls) how to build and provides feedback on what was built and when.

Data flowing from the ERP system to the MES include production demand, bill of materials, drawings, part programs, routing information, and process data. Data flowing from the MES to the ERP system include real time resource status, labor status, actual bill of material, actual routing and process data, product genealogy as built, and scrap levels. A conceptual view of these data flows is presented in Figure 8.25.

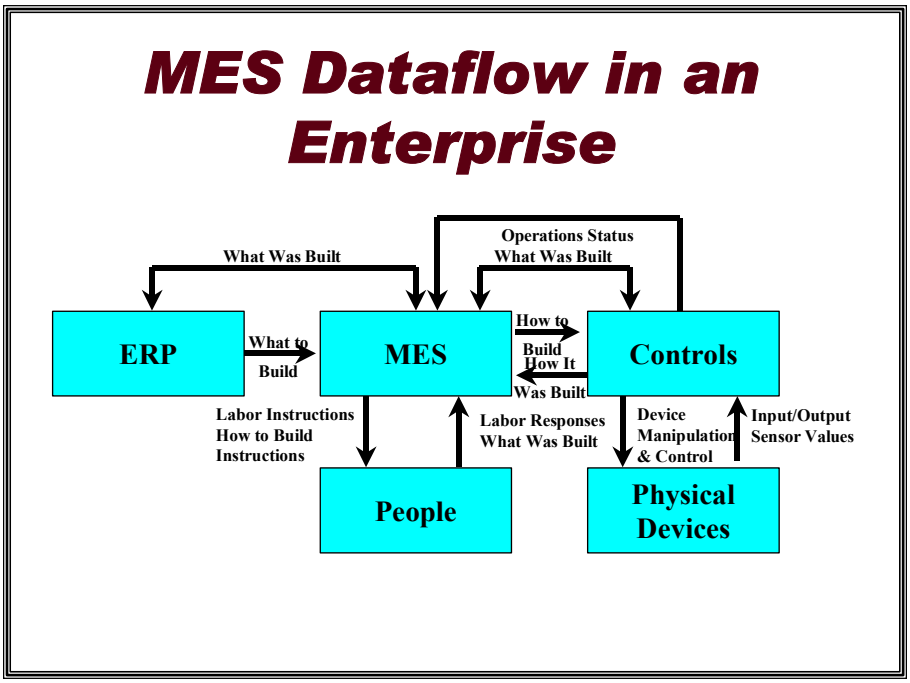


Figure 8.25: Conceptual Manufacturing Execution Dataflows

In 1995, it was estimated that roughly 80% of MES installations operate with Manufacturing Resource Planning II (MRP II) solutions. At that time, it was projected that there was a growing trend toward integrating MES solutions with ERP systems; i.e., integrating MES with order management, financials, distribution, etc. Largely, the projection was optimistic and remains unrealized, although progress has been made.

Examples of manufacturing execution functions include:

- View instructions for job setup,
- Examine drawing files to see how to machine the part,
- View or edit the numerically controlled part program,
- Examine the list of tools to confirm that they are all in working order,
- View the drawing file of the tools to see if they are correct and if there are any special instructions for the tool,
- Send the numerically controlled part program to the machine,
- Record job efficiency for setups, machining, and delays,
- Maintain a running log of information about the job, and
- Keep track of waste and scrap.

An example MES setup is presented in Figure 8.26

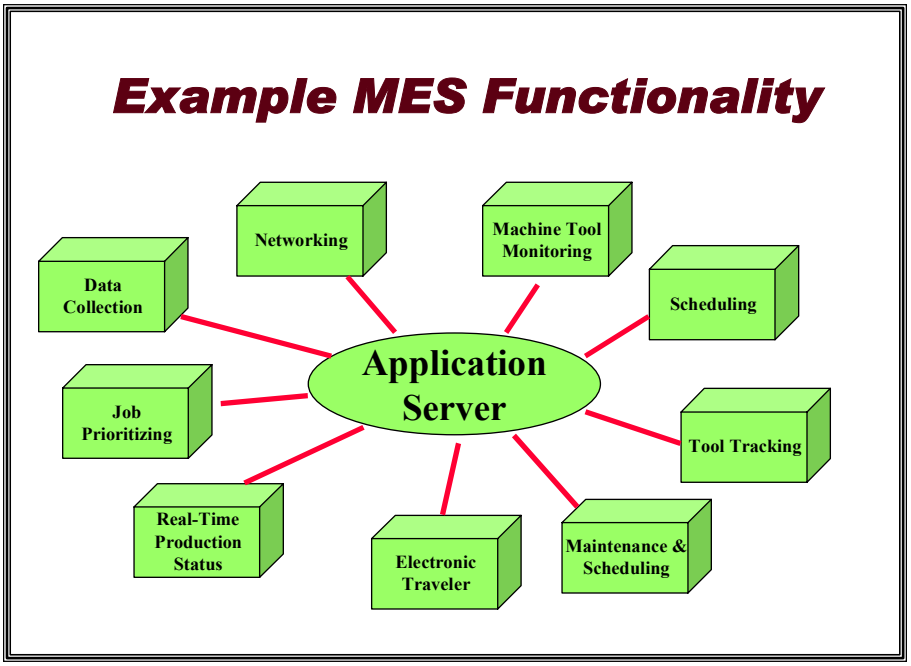


Figure 8.26: Example Manufacturing Execution Functionality

MES interoperability with ERP is difficult to achieve, but it is essential for integrating the enterprise. Progress has been made in recent years and modern manufacturing organizations are bridging this gap. They are implementing manufacturing execution systems, and they are building interoperable solutions with their enterprise solutions.

Industrial Base Modernization

We have reviewed the CSC Documentation on Industrial Base Modernization (Depots). This is a well-written document and it provides a credible strategy for implementing SAP with interoperable manufacturing execution solutions in the depots. To complete the national value chain, this SAP extension should occur. If it does not occur, the interfacing requirements from the depots to the national value chain will be significant cost drivers. The extension should be in accordance with the conditions outlined above, with a complete mapping to the Single Army Logistics Architecture. The implementation should be managed in Solution Manager, and the roadmap should be integrated with the overall program plan that is managed in the Office of the DALEI.

Relationship to Objective Force

The Objective Force

The Objective Force is a strategy to develop advanced information technology tools, vehicles and weapons that will make the Army's armored forces better able to survive an all-out fight. The first unit is scheduled to be equipped in 2008, with initial operational capability by 2010. The Objective Force was "designed to provide innovative capabilities to cope with the new operational environment relying on leaders and soldiers to out think and dominate our adversaries with superior speed of command and decisive action. It is capable of preemptive actions – able to anticipate and intervene in potential crisis situations before events progress contrary to U.S. interests. It is dominant across the full range of operations, to include those that can only be achieved with soldiers on the ground. The Objective Force in 2015 is an Army of hybrid capabilities, including 5 Units of Employment (UE), 15 Units of Action (UA), 6 Stryker Brigade Combat Teams (SBCTs), 2 1/3 Digital Division Corps, and a combination of heavy, light, and specialty forces brigades (airborne, air assault, Special Forces), USAR units, and 4 Multi-Functional ARNG divisions." (U.S. Army, *The Objective Force 2015*, 2002).

Future Combat System

The Future Combat System (FCS) is a key system component of the Objective Force. FCS will equip Army vehicles with information and communications systems to give soldiers capabilities for command and control, surveillance and reconnaissance, direct and non-line-of-sight weapons firing, and personnel transport. By definition, the FCS is directly related to the Field Army value chain that is included in the Single Army Logistics Architecture.

This architecture supports the collection, aggregation, and the dissemination of C2, logistics, and other data across the Field and National Army. The architecture has many of the same characteristics of the Single Army Logistics Architecture. Unlike the Single Army Logistics Architecture, however, it is focused on a single platform: the FCS.

There are two key components to the architecture:

- The Logistics Decision Support System (LDSS), and
- The Log Integrated Knowledge Environment (IKE).

We do not have a good understanding of the capabilities of the IKE, but the LDSS is "a collection of software services that support maneuver sustainment within the Unit of Action."

> Since PLM+ is the single entry point into the Single Army Logistics Enterprise, the IKE concept fits nicely. In fact, this substitution defines the IKE; it is PLM+. The architecture also preserves the single point of entry into human resources and medical, as well as providing access to DLA and other external sources. The big unknown is the Logistics Decision Support System. To our understanding, the LDSS is still a concept, existing only in an RFP. It is somewhat misleading to call LDSS a logistics application, since the proposed common services are C2. In fact, the LDSS is considered to be a C2 application that is focused on the FCS platform.

If the FCS is focused on a single platform, then it is a combined C2/Logistics mobile engine that is duplicative of the GCSS-A/T mobile engine. In fact LDSS would seem to duplicate much of the functionality that resides in the GCSS-A value chain. This is depicted in Figure 8.27.

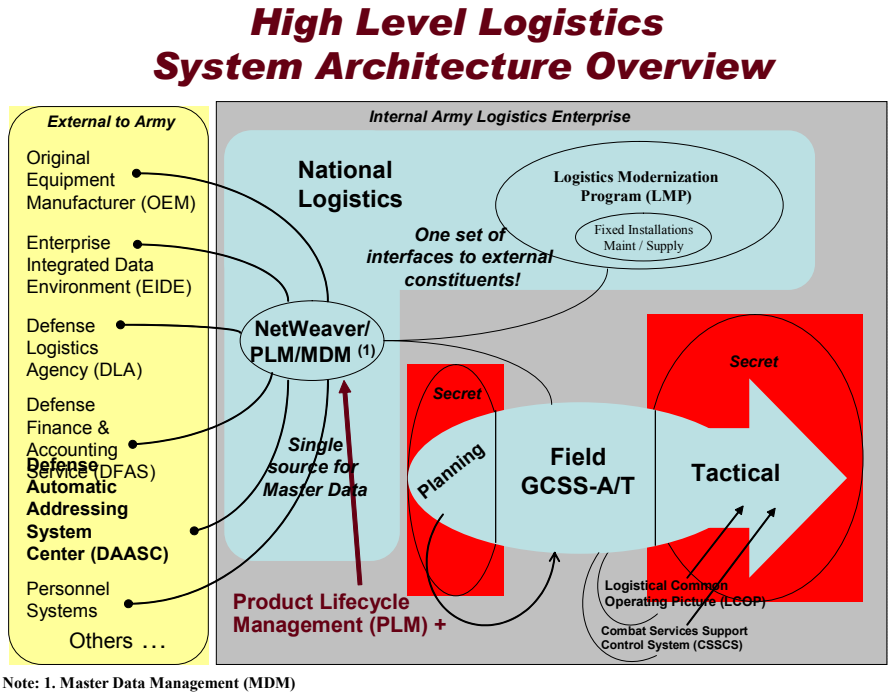


Figure 8.27: LDSS as a Replication Subset of the Field Army Solution

If this interpretation is correct, there are several implications. If FCS is proprietary and is associated with a particular platform, then multiple platforms will present significant interfacing problems for the field and national Army. That is, LDSS is a separate C2/Logistics system that sits outside of the Single Army Logistics Enterprise. It has the potential to duplicate much of the logistics functionality in SAP, but with proprietary coding and protocols.

From a total Field Army value chain perspective, LDSS merges logistics and C2 into the same system. If the single system of record for logistics is SAP, this is a problem that must be resolved. Furthermore, if the LDSS has detached capabilities at the platform level, then this places LDSS in direct conflict with the SAP mobile engine implementation of GCSS-A/T. SAP cannot handle LDSS as a detached/mobile solution. As previously discussed, SAP detached and mobile solutions must abide by the principles of replication and synchronization, and these principles do not apply to proprietary software. Succinctly stated, there is direct conflict between the scopes of GCSS-A/T and LDSS. The scopes overlap in the logistics domain.

In the larger sense, there is no conflict between the FCS architecture and the Single Army Logistics Architecture. The inclusion of the PLM+ hub that is enabled by NetWeaver solves a significant FCS unknown variable by defining the Integrated Knowledge Environment, an unknown in the FCS architecture. If the logistics part of LDSS is aligned

for direct interaction with SAP (so there is one set of logistics master data), then FCS can align with Army ERP. However, it is impossible to tell if this will happen. The LDSS RFP is already written, and it is unclear how the potential contractors will respond.

Condition Based Maintenance (CBM+)

Integration with Weapon Platforms

Logistics chain efficiency comes from making good decisions based on accurate knowledge. There is always an inherent tension between the cost of gathering the data and the measurable improvement in efficiency, operational needs, etc. Technology improvements are driving down the deployment costs of supply chain tracking in two important areas:

- Network connections to the weapon platform, and
- Electronic tags for tracking the movement, environment and location of items using Automated Identification Technology (AIT) such as RFID Tags.

Smart Distribution

Smart Distribution is one clear case in which this architecture can leverage supply information from the weapon platform (e.g. fuel, ammunition, etc) that can be used to improve and reinvent business processes that will allow logisticians to drive effectiveness and efficiencies as well as operational superiority.

This scenario illustrates the Smart Distribution Concept:

1. Weapons Platform reports inventory,
2. Native platform message is sent to MIMOSA Universal Translator,
3. MIMOSA Universal Translator converts message into MIMOSA XML message,
4. A Mobile Engine Application converts MIMOSA XML message into the proper format to initiate the creation of the proper SAP business document on the Mobile Engine,
5. Soldier opens SAP business document (e.g. goods issue),
6. The Mobile Engine Application will send the good issue to the SAP Back End. The replenishment rules will be verified, and
7. The Weapon Platform is replenished.

This smart distribution scenario is presented in Figure 8.28.

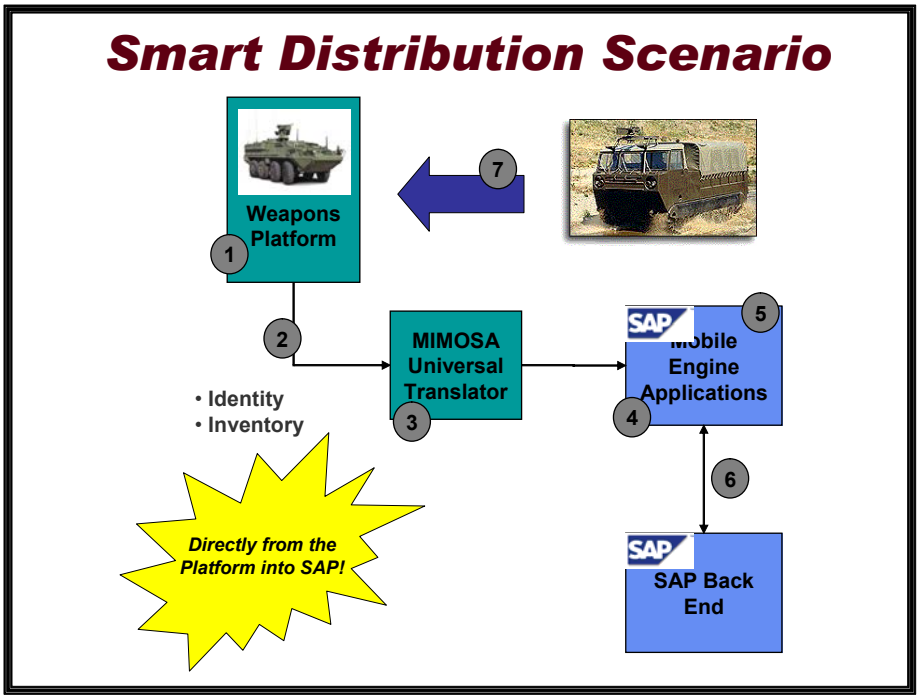


Figure 8.28: Smart Distribution Scenario

CBM+

The US DoD is moving toward CBM+ (as requited by the Future Logistics Enterprise), with more accurate predictions of impending failures based on condition data. Implementation should result in dramatic savings and improved weapon system availability to meet Combatant Commanders' requirements. CBM+ focuses on inserting technology into both new and legacy weapon systems that will support improved maintenance capabilities and businesses processes. It also involves integrating and changing business processes to improve logistics system responsiveness. Under consideration are capabilities such as enhanced prognosis/diagnosis techniques, failure trend analysis, electronic portable or point of maintenance aids, serial item management, automatic identification technology and data-driven interactive maintenance training. The ultimate intent of this initiative is to increase operational availability and readiness throughout the weapon system life cycle at a reduced cost.

The scenario (Figure 8.29) illustrates the CBM+ concepts that will be enabled by this architecture.

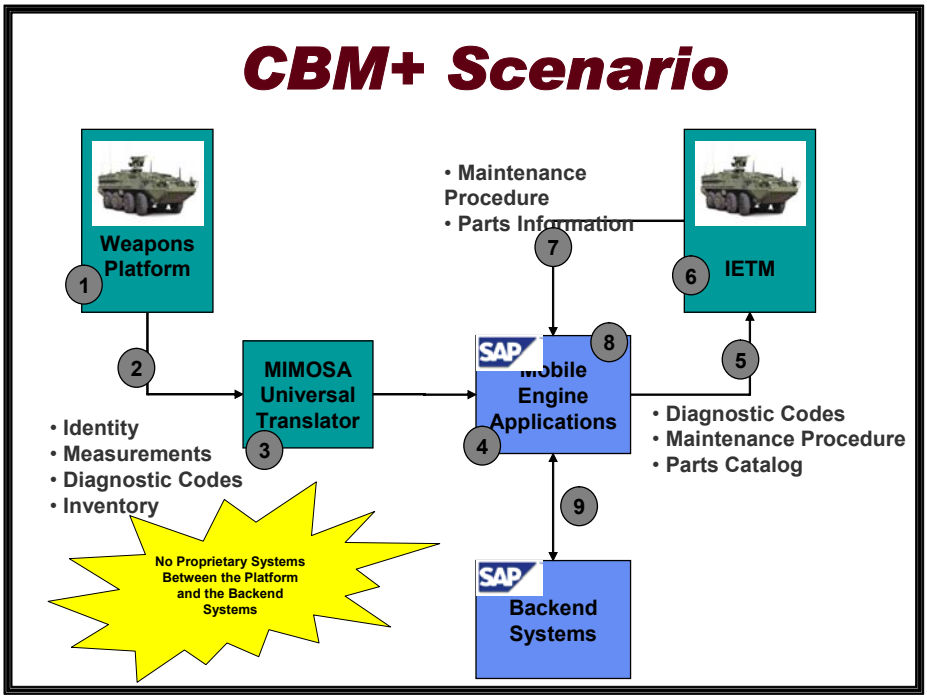


Figure 8.29: CBM+ Scenario

These are the steps in the scenario, as it would be implemented under the business processes in the Single Army Logistics Enterprise architecture.

1. Weapons Platform reports an event (malfunction, measurement, inventory, etc.),

2. Native platform message is sent to MIMOSA Universal Translator,

3. MIMOSA Universal Translator converts message into MIMOSA XML message,

4. A Mobile Engine Application converts MIMOSA XML message into the proper format to initiate the creation of the proper SAP business document on the Mobile Engine,

5. Soldier opens SAP business document (i.e. maintenance order, maintenance notification, measurement document, good issue, etc) and initiates work (If this is a maintenance action, soldier may be required to consult IETM),

6. Mobile Engine Application will send a request to the IETM to be launched at the proper location,

7. Soldier consults IETM (i.e., troubleshooting information, Repair Parts & Special Tools List, or maintenance instruction),

8. IETM may return information back to the Mobile Engine Application such as high-level maintenance procedure or parts information,

9. Soldier completes work. Soldier may consume parts that are considered “bench stock” or may requisition other parts, and

10. Appropriate SAP business documents are exchanged between the Mobile Engine Application and the SAP Back End System. This may include completed work order and notification, parts requisition, new work orders or notifications generated by the backend system, etc.

Recommendations

While SAP can support this integrated scenario, there are a number of issues that must be worked by the Army before the scenario can be implemented. The following prerequisites must be in place:

- Industry and the Army must insert enhanced diagnostic & prognostic engineering capability into both new and legacy weapon systems to support improved logistics processes,
- The Army must adopt the MIMOSA XML standard for the exchange of condition data between the weapon platform and business applications,
- The Army must adopt the SAP Open Catalog Interface XML standard for interfacing the IETM parts catalog (part of the Repair Parts & Special Tool List) and SAP business applications, and
- The Army must develop an XML standard for the exchange of maintenance items between the IETM and the SAP business applications.

Chapter
9

Business Process Analysis with the SAP Solution

Analysis of Business Process Gaps

The business processes in the Army Single Logistics Enterprise Architecture is the single integrated solution for logistics. However, from a Future Logistics Enterprise point of view, there is a major gap. The weapon system program office engages the OEM in collaborative product development, and this is usually accomplished using the native proprietary CAD environment. Once the asset is fielded, the as maintained product data is shared with the logistics community to support the sustainment phase of TLCSM. Historically, this sharing has not been seamless nor integrated.

The Single Army Logistics Enterprise Architecture's representation of TLCSM requires that the acquisition and sustainment functions share the same standard software in order to provide total visibility across the entire weapon system lifecycle. Hence, the weapon system program office must be a part of the integration domain.

From a comprehensive viewpoint, the primary gaps in the Army's SAP solution are Financial, HR, Acquisition (especially FAR-logic), and Installations. All of these areas affect logistics, but many are outside the control of the Army; e.g., DFAS. Commercial ERP products are tightly integrated around value chains; hence, materials, dollars, people, and other assets are tracked on an end-to-end basis. The requirement to interface with financial, human resources, and other domains compromises the integration integrity of the software, causing ROI to decline. Hence, the Army long-term strategy must be directed towards an integrated solution that includes financials, human resources, and other assets. The DoD must reach the point where the financial and human resource managers use the same integrated system as the rest of the enterprise, as opposed to owning their own stovepiped systems. Since total integration is not achievable in the short-run, the Army must focus on managing those business processes that are completely under the control of the Army. This implies that all Army-to-Army interfaces must be eliminated.

This suggests two types of business process gaps.

- Gaps that are caused by being mandated to exit to an external application.
- Gaps that are caused by the inability to achieve internal integration.

The fist type of gap is more difficult to close, since closure requires obtaining a waiver from the mandating organization. The latter type of gap may be hard to close, but at least it is achievable, since it only requires internal agreement.

Analysis of Integrated Knowledge Environment (IKE) Gaps

The Future Logistics Enterprise assumes an Integrated Knowledge Environment (IKE). The IKE implies that all relevant data about a business process (or collections of business processes) is available to support decisions in near real-time. Gulledge, et al. (1999), explain the concept in detail[18].

For near-term FLE initiatives, the IKE is not as restrictive as one might assume. As Foley (2002) notes, the technology is available, and many companies are investing in real-time business:

> Imagine a company that can offer targeted incentives the moment a customer calls, track products in real-time as they move from warehouse to store shelves, almost immediately close its books at the end of the quarter, and give senior executives up-to-the-minute reports on key operational data…Real-time business requires synchronizing business processes with computers that manage and distribute data as events occur (Foley, p. 36).

The Integrated Knowledge Environment (a defense concept) equates to Real-Time Management (a private sector concept). Compaq calls the IKE "Zero Latency Enterprise Environment." Other companies have similar concepts, but the "point of creating a real-time business is to have a healthy business model, one with low inventory, high productivity, and responsiveness, while providing an experience that customers can't get anywhere else."

The IKE is addressed in the Systems and Technical Views, but the point of this discussion is that the IKE is feasible with today's technologies. ERP provides transaction processing and data aggregation capabilities needed to field an IKE, but not all organizations are enabled by ERP. For companies with geographically distributed operations, a robust data communication infrastructure must operate in conjunction with the ERP to achieve an effective IKE. Hewlett-Packard provides its IKE through its own servers and a NonStop SQL database layered with middleware from companies such as BEA Systems, Iona Technologies, SeeBeyond Technology, Tibco Software, and WebMethods. These are traditional commercial Enterprise Application Integration (EAI) packaged solutions, and they are used when it is **impossible** to include a particular application in the integration domain. Furthermore, while these applications accommodate SAP, they are not optimized for SAP. Hence, our proposed IKE solution is NetWeaver, an EAI solution that is optimized for SAP, while maintaining the ability to interact with legacy applications like the above applications.

Is the Army lagging in commercial best practice in its quest to implement an IKE? Gareiss (2002) provides some data to address that question. "Only 32% of business-technology executives say they have an infrastructure capable of supporting instantaneous data delivery." The same survey indicates that there is significant demand for IKE services, with 74% of executives requesting reductions in the time that it takes to provide data. The study identifies the following key components for delivering the IKE: fault-tolerant servers, storage, advanced routers and switches, high-speed bandwidth, handheld devices, business-continuity planning, and a secure network.

[18] The older terminology, Integrated Data Environment, is used in this paper.

The IKE is not currently available in the Army. While it represents commercial best practice, the data suggests that the IKE is not widely available in the private sector either. However, it is available in leading innovative organizations. The Army logistics operational architecture assumes such an environment, and the logistics SA and TA provide the mechanism for planning for such an environment. These issues are addressed in the following sections.

Analysis of NetWeaver

NetWeaver is an SAP product that is used to construct what Gartner calls a Composite Application (Valdes, et al., 2002). Gartner notes the following:

> "In recent years, a notion has arisen of a new, more-efficient approach to building applications. This particular vision has been labeled Composite Applications or Composite Apps. The general notion of composite apps is that they are composed of pieces of other applications (logic and data). They can be viewed as enterprise-level applications built at tactical speed with a minimum of coding, by using integration technologies to draw on code and data repositories within the enterprise. Beyond this general notion, there is a wide variation in the vision, as espoused by different vendors in different product sectors.

Within the above context, the Army's logistics solution qualifies as a Composite App[19] that is linked together with the NetWeaver solution. The composite application platform is presented in Figure 9.1.

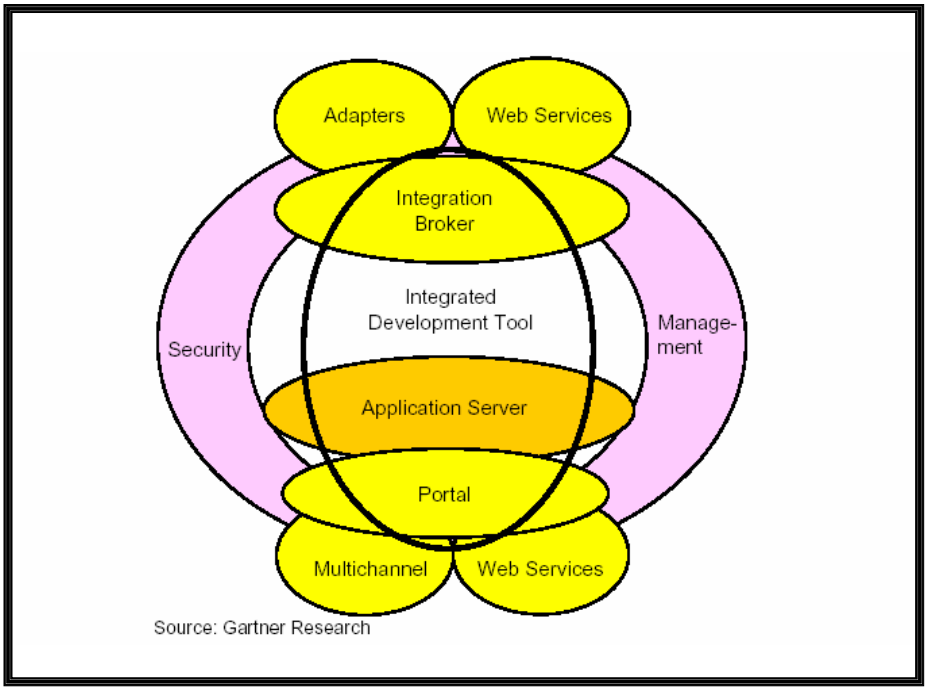


Figure 9.1: Composite Application Platform

[19] A more proper term would be a portal-hosted composite application.

A summary overview of the NetWeaver components demonstrates how the NetWeaver solution aligns with the Gartner concept of a Composite Application Platform. This overview is presented in Figure 9.2.

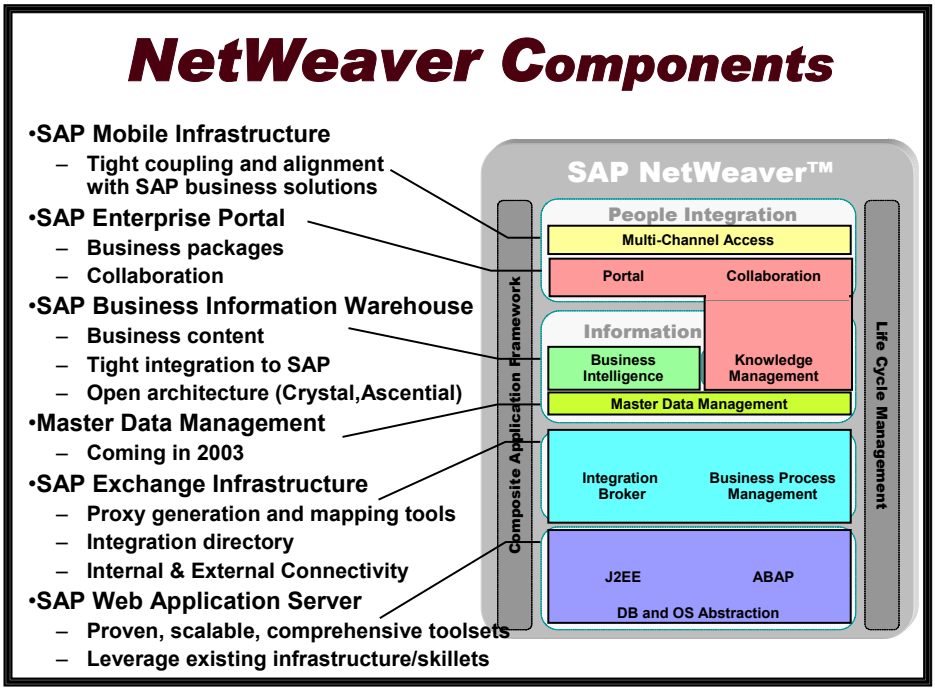


Figure 9.2: SAP NetWeaver Components

The next point is key for understanding NetWeaver. With one exception, NetWeaver is not a new product. As can be seen in Figure 9.2, NetWeaver represents the bundling of existing SAP products. The single exception is Master Data Management, which is given special attention in a later section. Also, since the Exchange Infrastructure is also critical to the Army Single Logistics Enterprise architecture, this topic is discussed in detail in a later section.

The Army has already invested in SAP, so NetWeaver is the next step in a logical progression for the Army. The new SAP architecture, the Enterprise Services Architecture, is a Web Services-based architecture. NetWeaver implements the Enterprise Services Architecture, and SAP is designing all solutions to run on an Enterprise Services Architecture. This provides risk mitigation to the Army, since NetWeaver is indeed the technical foundation for SAP's future.

Analysis of Exchange Infrastructure

The SAP Exchange Infrastructure (XI) enables inter-system communication in a heterogeneous, multi-vendor technology environment. XI combines traditional Enterprise Application Integration (EAI) technology for communicating with external systems, while using optimized internal messaging across SAP components. This is a key component of the Army's architecture, because SAP Master Data Management runs on top of XI, enables master data integration. That is, during distribution, SAP MDM uses XI to transport business objects to predetermined local systems within the distributed IT

environment. XI provides unique routing execution, queuing, and format conversion capabilities for the secure transport of objects to their proper destinations.

XI follows a hub and spoke publish/subscribe model of EAI. Objects (or other data) marked for distribution are sent to the XI platform using open protocols and standards such as HTTP, XML, and XSL. This is the publishing component of the mechanism. A central routing model within the XI platform stores information regarding which systems want access to the objects (or other data). This is the subscribe part of the mechanism. When it receives new data, XI performs value mappings (required for objects identified by different keys in multiple systems) and structural conversions (used for semantically equivalent types that are syntactically or structurally different). Once properly prepared, XI distributes the data to interested systems using a queuing mechanism that guarantees that messages are delivered consistently and exactly once. Put simply, XI evaluates each object, places it in a queue, and then distributes the objects in an order that maintains transactional integrity across the various systems.

Internal and External Communications

This section is critical for understanding why we are recommending SAP as the solution for the brokering of technical data across the Army logistics enterprise. We have already discussed that SAP's PLM solution minimizes interface requirements across the field and national Army. However, there is also a pure technical reason for selecting the NetWeaver solution with Exchange Infrastructure. For transport across SAP components, the communication uses native SAP messages (e.g. IDocs) optimizing the movement in high volume situations where XML overhead would be too high. For external systems, traditional connectors are used. Figure 9.3 provides an overview of this hub and spoke model, and Figure 9.4 depicts the external and internal communications processes.

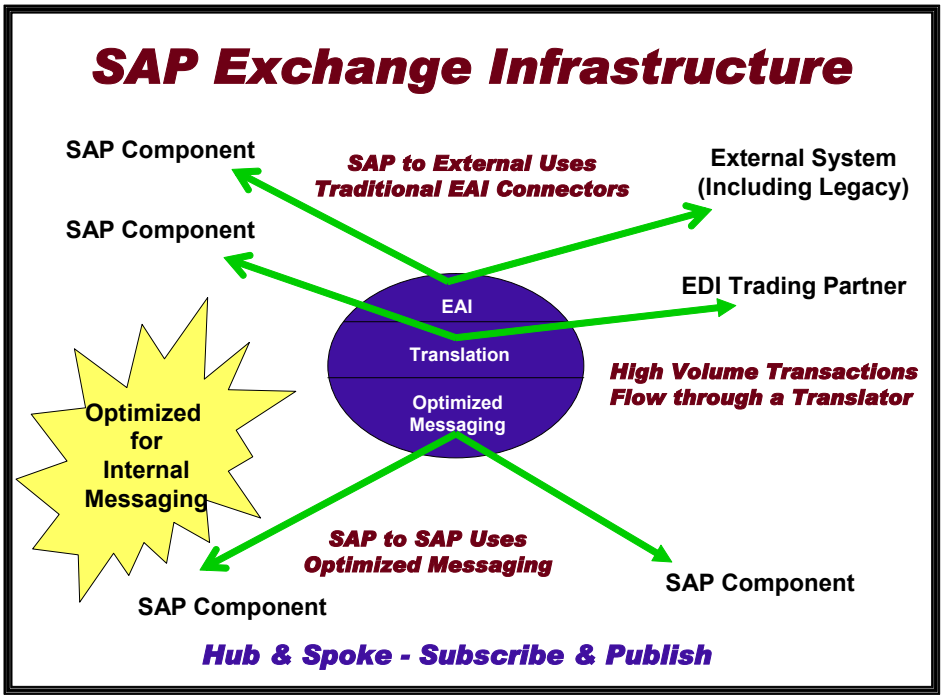


Figure 9.3: Conceptual View of SAP Exchange Infrastructure

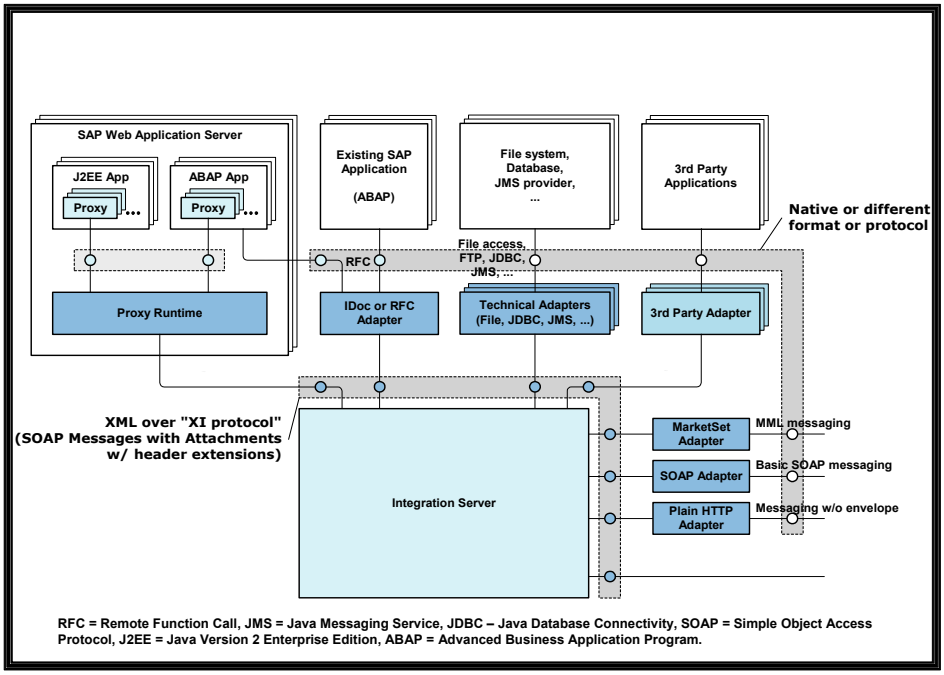


Figure 9.4: Internal and External Communications with Exchange Infrastructure

These figures show the messaging flows and system components across SAP and non-SAP components. For non-SAP components, traditional EAI connectors are used, but messaging among SAP components is optimized using SAP technologies. This was a critical point for understanding why we recommended that SAP technologies be used in the hub that is aligned with PLM+.

The technical design of the XI allows for the sharing of business semantics, which eases the integration of both external and internal components. Instead of directly coding point-to-point interfaces for each new component, SAP XI allows instant plug-in of new components once per component. Further, the various adapters allow for optimized messaging specifically tailored to various architectural landscapes. This provides the flexibility that is required in today's fast-changing world, and it reduces integration costs

Analysis of Master Data Management

Master Data

In the SAP standard software solution, Master Data is data relating to individual objects, which remains unchanged over an extended period of time. Master data contains information that is used in the same manner for similar objects. Examples would be the master data of a supplier containing name, address, and banking information, or the master data of a user in the R/3 System, containing the user's name, authorizations, default printer, etc.

Master Data Management

For the Army Single Logistics Architecture solution, the management of master data across multiple systems is a critical requirement. The Army has made the decision that one set of master data is the only acceptable solution. The architecture is constructed to accommodate this requirement. Our recommendation is that the SAP Master Data Management (SDM) solution be implemented, since this solution preserves the integration domain while minimizing interfaces.

The SAP MDM solution consolidates master data objects, harmonizes the master data, and supports the maintenance of a complete object definition, including object dependencies, in a centralized server for master data. The SAP Master Data Management solution is a component of the NetWeaver architecture, and the master data management process, MDM uses the SAP Exchange Infrastructure (XI) to transport business objects to predetermined local systems within the distributed IT environment. While MDM is responsible for defining business objects and maintaining them over time, XI provides unique routing execution, queuing, and format conversion capabilities for the secure transport of objects to their proper destinations.

Master Data Server

The Master Data Server (MDS) serves as the central processing unit for the handling of master data across the enterprise. It is ultimately the MDS that enables the consolidation, harmonization, and distribution of the master data across the Army logistics enterprise. While all data is administered by the MDS, data creation and maintenance can be executed within both the MDS and the connected local systems (LMP and GCSS-A/T).

MDS tasks and capabilities are classified under three layers:

- Object Layer: The object layer describes the master data objects in a flexible and extensible way.
- Service Layer: The service layer provides generic services and methods for the management of master data. These include object creation, change and status management, querying, routine maintenance, authorization, workflow, collaborative data cleansing, etc. Services can also be exposed as Web Services where necessary.
- Provisioning Layer: The provisioning layer controls master data distribution in tight integration with SAP's Exchange Infrastructure.

A visual representation of Army MDM is presented in Figure 9.5.

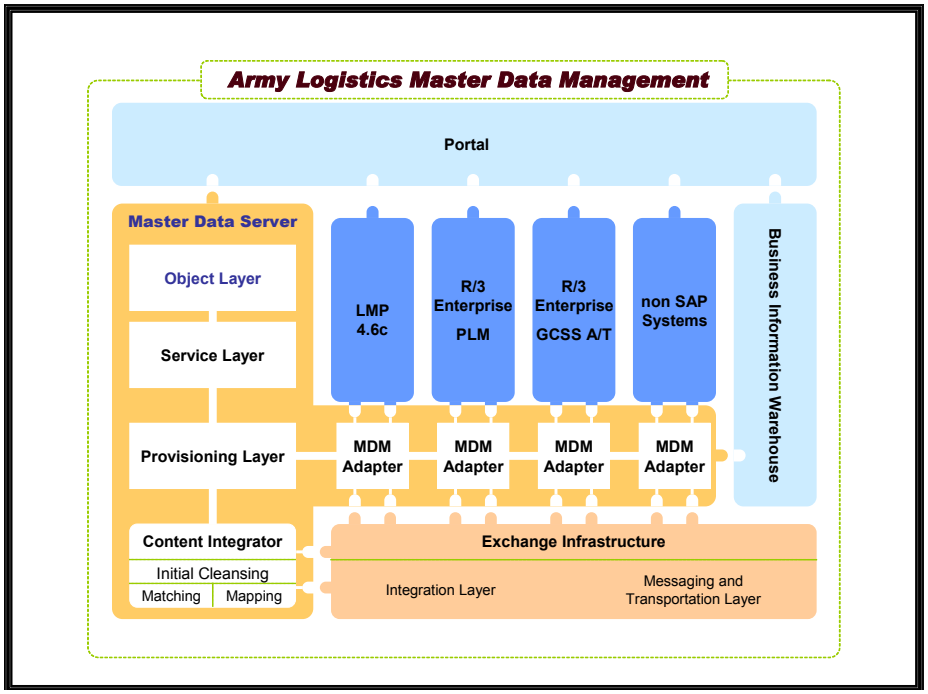


Figure 9.5: Army Master Data Management as part of the PLM+ Solution Component

In Figure 9.5, the Master Data Server is part of the PLM+ solution.

Analysis of the MDM Solution

The SAP MDM solution is a new component in the NetWeaver solution. Product development was frozen in February 2003, and the first version of the product will be shipped in the third quarter of 2003. The initial shipment will probably be a mature product, however it is limited in that it will not be operational for all data masters; i.e., the first releases will be the customer and vendor masters. Since this product is a critical part of the Army solution, we analyzed it in more detail. This analysis included some extensive discussions with SAP America and the MDM development team at SAP AG.

Our interviews revealed the following. SAP has been managing master data across components for years. However, this form of master data management has been on a component-by-component basis. For example, MDM across R/3 and APO might be handled differently than across R/3 and CRM. The SAP customer base has demanded a common approach for managing master data, and the new MDM component in NetWeaver is SAP's response to the customer.

The implication is that the MDM product is not a completely new offering, but a consolidation and standardization of multiple existing approaches to the management of master data. This implies a contingency plan with a migration path if MDM does not mature as scheduled[20]. If SAP deviates from the current roll-out plan, the component-by-

[20] In the section that describes the integrated schedule, we show that the current MDM product roll-out schedule can meet the Army's needs. However, if there is schedule slippage or a maturity problem, this could affect the schedule. Therefore, we imposed the requirement that a fall-back approach with a migration path be available.

component approach could be used, with a migration to MDM on a new roll-out plan. SAP has confirmed that such an approach is possible. However, we fully expect that SAP will meet its roll-out commitments, and we are confident that MDM will mature as promised. Our intent was to ensure that the Army has a contingency plan, given that MDM is a critical component of the solution.

Detached and Mobile Operations

It is essential during deployments and exercises to be able to carry out the logistic and administrative core processes of an organizational element independently of the connection to a central SAP system.

The fundamental requirements for detached and mobile operations can be expressed as:

- Model the personnel and materiel structures for the Army in the system,
- Support the Army's missions in all phases of deployment operations,
- Highly available IT functions that promote self sufficiency,
- Planning, buildup, deploy and support of Army contingents,
- Organizational flexibility, and
- Integrated with the associated business processes, such as finance and human resources.

Detached and Mobile Operations Architecture

The proposed architecture will provide the ability to operate in an (possibly) interrupted communications environment. The solution supports relevant logistics business processes without assured communications and re-synchronizes data automatically when communications become available. This is required as the availability of communication infrastructure due to movement, silence procedures, electronic warfare, combat action/ engagement, weather, etc will not be 100% assured.

The architecture is composed of the following basic components:

- Homeland system,
- Deployed SAP Mobile Engine,
- Deployed SAP Consolidation Reporting Server, and
- Deployed Logistics Execution System.

These three levels are depicted in Figure 9.6.

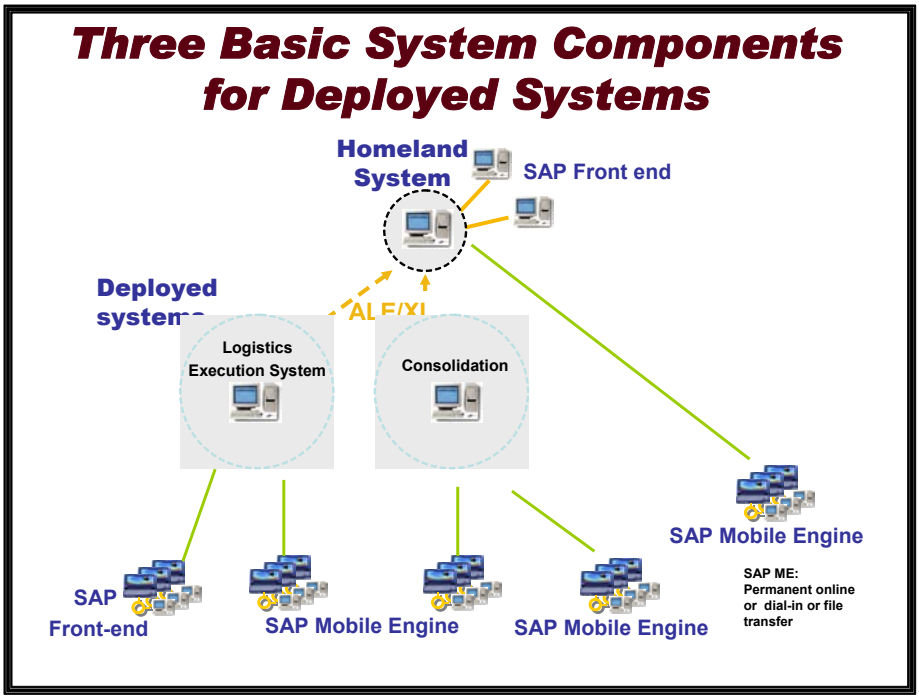


Figure 9.6: Three Components for Deployed Systems

Mobile Engine Analysis

During the early part of our study, we spent considerable time understanding the capabilities of the SAP Mobile Engine. We were told that we should pay special attention to this solution, so studied it in detail, including traveling to Germany to meet with the development team, and also meeting with the German Bundeswehr implementation team, where the product is being jointly developed with SAP. Our conclusion is that while the product is immature, it is real, and it will be able to meet the Army's needs as it evolves according to the integrated schedule.

The mySAP Mobile Business solution is a universal platform for all popular mobile devices in both connected and disconnected environments. SAP's Mobile Engine is an integral part of NetWeaver and is the technology component that allows operation in a disconnected environment. It is based on secure & open standards:

- Standard browser front-end,
- Platform independent,
- Connect to multiple backend systems – SAP and non-SAP,
- WEB services enabled synchronization with backend systems,
- Access management, and
- Secure network communication.

Installed locally on each mobile device, the SAP Mobile Engine includes its own Web server, database layer, and business logic, which are all part of a light-installation run-time environment that extends a subset of the "connected" business processes to users

whether or not they're connected to the network. SAP Mobile Engine provides a synchronization and replication layer that resolves enterprise-level data redundancy by synchronizing the mobile device with back-end systems through a specially configured WEB Application Server. SAP Mobile Engine also includes a centralized, role-based console that simplifies administration tasks in the US Army IT environment. The architecture is presented in Figure 9.7.

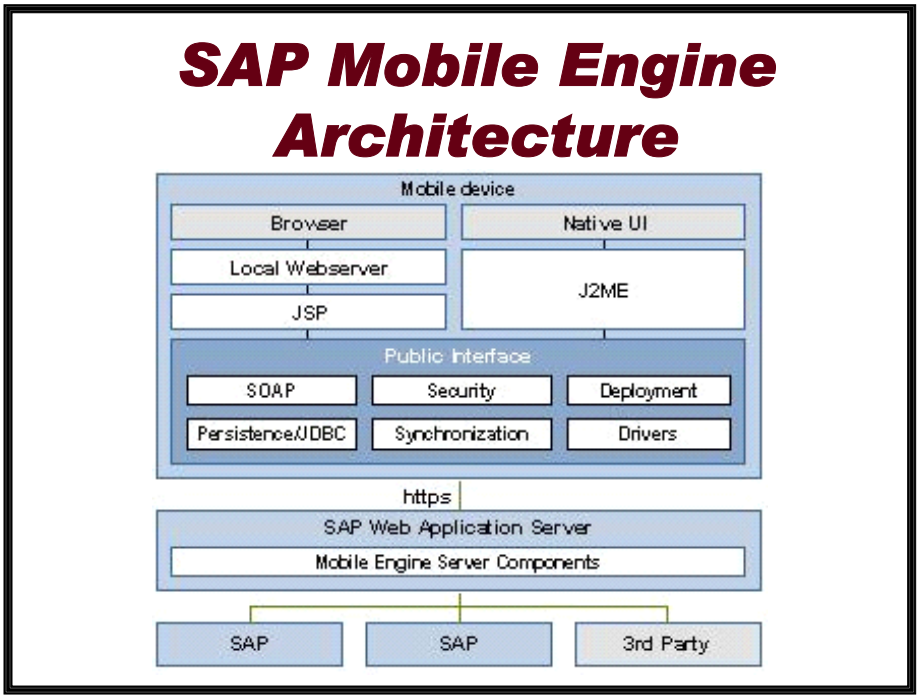


Figure 9.7: SAP Mobile Engine Architecture

The development of the SAP Mobile Engine has been greatly influenced by military requirements and the collaborative work conducted between SAP and the German Bundeswehr. This influence is highlighted in Figures 9.8 and 9.9.

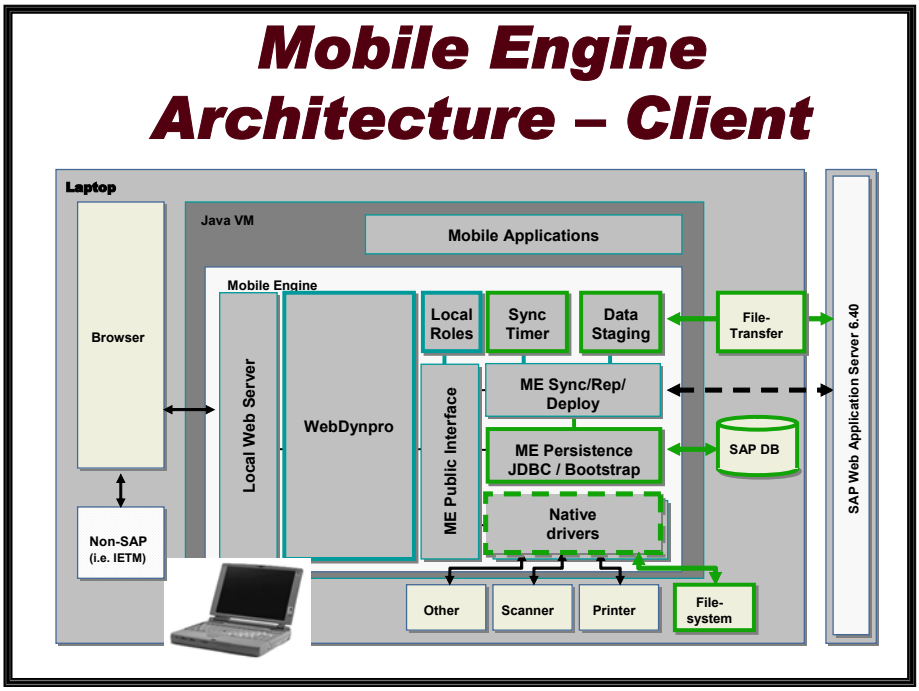


Figure 9.8: Mobile Engine Architecture - Client

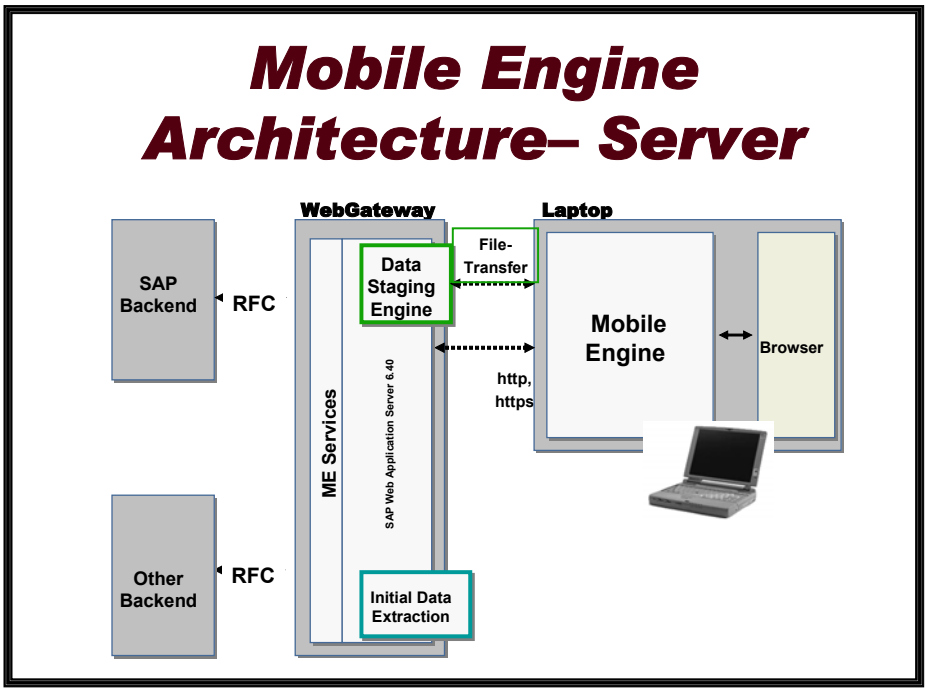


Figure 9.9: Mobile Engine Architecture - Server

The two figures above highlight the SAP Mobile Engine components that have been influenced by the military requirements that will be made generally available to all SAP customers:

- Green: WEB Application Server 6.20 & ME 2.1 SP1
- Blue: WEB Application Server 6.40 / ME 2.5

Synchronization & Replication Layer

While the mobile device provides local transaction logic, SAP Mobile Engine includes the synchronization and replication components that connect the mobile user to the full range of resources available from GCSS-A/T and the PLM+ hub. Synchronization provides secure, encrypted, and compressed data transfer between the mobile device and any back-end server via SAP Mobile Engine and its middleware server. Executed over HyperText Transfer Protocol with Secure Sockets Layer (HTTPS), synchronization uses standard connection types such as Global System for Mobile Communications (GSM), GPRS, LAN, wireless LAN, removable media and cradles.

Replication is a central issue of concern for the Army. The mobile application is a subset of the business processes from the enterprise solution. That is, the transactions that are configured on the mobile device are a subset of those that are configured in the enterprise configuration. Since the enterprise solution is complex, spanning LMP, PLM+, and GCSS-A/t, this configuration must be closely monitored and managed across Army logistics.

The replication and synchronization component, which includes a toolkit for building objects and monitoring user synchronization and replication processes, uses SAP Web Application Server to provide automatic delta determination and data assignment to users and user groups. These concepts are presented in Figure 9.10.

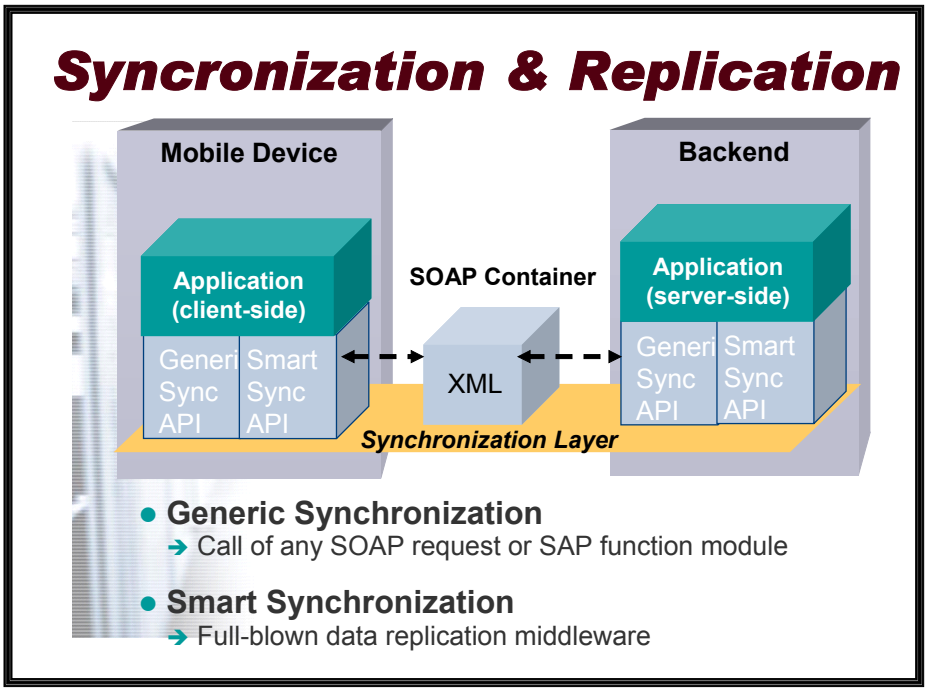


Figure 9.10: Synchronization and Replication

As illustrated in the figure above, the replication and synchronization component provides two types of exchange mechanisms between the client and the back-end:

- Generic Synchronization – in this case, the business process logic of the ERP system is re-used and the existing landscape is extended in the mobile work environment. The mechanism is used for synchronizing transactional business objects (e.g. maintenance work order, goods issue, etc)

- Smart Synchronization – in this case, the system provides a full-blown replication mechanism based on SAP's on extracts of the Business Object Repository (BOR). The system ensures that only the necessary and sufficient master data objects are synchronized to users based on their role. The system also conducts automatic delta determination and conflict resolution each time synchronization occurs.

Mobile Engine Administration

For installations, upgrades, and device configuration tasks, SAP Mobile Engine includes a Web-based administration component that speeds and simplifies these common tasks. Based on the SAP standard role system and integrated into mySAP Enterprise Portals, the administration console provides:

- Central application installation and deinstallation,
- Automatic download and rollout of new or updated applications based on roles or device parameters,
- Central management capabilities by user, device, application, version, or role, and
- A central error log to locate and fix potential problems.

Recommendations on Mobile Engine

Our instructions in developing the architecture was to not only focus on technologies that are mature today but to also focus on technologies that will be mature in the 2006-2008 range, and. The SAP mobile engine is not mature today, but it will be mature in the 2006-2008 range. Of course, the big benefit is that the SAP Mobile Engine is completely integrated with the Single Logistics Enterprise solution. It is not interfaced, and it is not platform dependent. Our bias is always in the direction of integration as opposed to interfaced proprietary platform-specific devices, as long as business process requirements are met. We recommend that the Army engage the SAP development team to influence current development efforts, and through this process, ensure that U.S. Army requirements are met.

Mobile Engine Applications

Materiel Management Applications

The core functions required for supporting material management processes are also provided as mobile applications. This means that material requests, return of goods, transport and service requirements, and goods movements can be entered in mobile devices.

This information is subsequently synchronized with the SAP system via a previously established connection that initiates the follow-on processes and generates the corresponding documents. During the synchronization, the documents generated – for

example, a delivery status – are reported to the mobile application, so you can monitor the status in the mobile device without continuous connection to a central SAP system.

Army personnel will also obtain an overview of supplies, stock loads, authorized and actual material, and more. Goods movements entered in the mobile equipment lead to immediate updates of the relevant overview. The stock overviews in the corresponding SAP system are adjusted after the next synchronization.

Maintenance Management Applications

The core functions of maintenance management – such as processing notifications and orders and installing or removing components from technical objects – are available as mobile applications based on SAP Mobile Engine.

For example, a maintenance sergeant can use a laptop computer to create and process a maintenance notification. A technician's work is available in a report of maintenance notifications and orders. Soldiers will also document the planned installation and removal of components from technical structures, and will update their status. They will also be able to access the complete current assembly status of the assigned technical objects without being connected to a central SAP system.

The information processed on the mobile device – for example, maintenance notifications and orders and the corresponding confirmations of time, material, and so on – is available in the central SAP system after synchronization.

Consolidation Reporting

There is a need to provide some limited management reports while disconnected from the homeland system. These may include, deadline reports, controlled stock overview, etc. The consolidation reporting server will aggregate data from the various SAP Mobile Engine applications under it's reporting responsibility to provide a consolidated view of the situation to those that require it.

Logistics Execution System

The operation of deployed supply units, such as Supply Companies in Forward Supply Battalion, will require a transactional system that is more suited to their needs than the SAP Mobile Engine. This is particularly required by the high throughput of goods in those units. The SAP Logistics Execution System can be run separately from the homeland SAP system. It is quite scalable and will accommodate the needs of the various supply units.

The deployed supply units will implement the decentralized warehouse management system of SAP's Logistics Execution System (LES) and operate the processes of a distribution center. The LES enables the handling of a decentralized warehouse processes from planning aspects and goods receipt to storing and goods issue as well as monitoring the warehouse activities including the transferring goods directly from the goods receipt area to the shipping area (cross-docking).

SAP LES is completely integrated with SAP's Environmental, Health, and Safety to manage the handling and storage of hazardous material, such as ammunition, based on characteristics that are defined in the hazardous material record.

The LES also provides the ability to integrate a variety of Automated Identification Technologies (AIT) into the process. For example, Soldier will be able to scan the information that needs to be recorded, such as storage unit numbers, using a bar code or RF Tag, and also use the information to verify the storage bins.

Analysis of the SAP Technical Solution Relative to the Architecture

SAP R/3 Scalability

Our architecture team spent considerable time understanding the technical aspects of the NetWeaver hub. SAP Standard Application Benchmarks test and prove the scalability of mySAP Business Suite solutions. The benchmark results provide basic sizing recommendations for customers by testing new hardware, system software components, and Relational Database Management Systems (RDBMS). They also allow for comparison of different system configurations.

The original SAP Standard Application Benchmarks have been available since R/3 Release 1.1H (April, 1993) and are now available for many SAP components. The benchmarking procedure is standardized and well defined. It is monitored by the SAP Benchmark Council made up of representatives of SAP and technology partners involved in benchmarking. Originally introduced to strengthen quality assurance, the SAP Standard Application Benchmarks can also be used to test and verify scalability, concurrency and multi-user behavior of system software components, RDBMS, and business applications. All performance data relevant to system, user, and business applications are monitored during a benchmark run and can be used to compare platforms and as basic input for sizing recommendations. SAP maintains a public WEB site where it publishes benchmark results: http://www.sap.com/benchmark

The Sales & Distribution (SD) Benchmark with a 3-tier architecture provides a reasonable model of scalability of the SAP R/3 with respect to the Army Logistics Architecture. A 3-tier configuration includes separate operating systems on separate physical machines. Also, a single system with separate operating systems when it is not possible to run one operating system on the whole system is considered 3-tier. The SD Benchmark consists of the following transactions:

- Create an order with five line items (transaction VA01)
- Create a delivery for this order (VL01)
- Display the customer order (VA03)
- Change the delivery (VL02) and post goods issue
- List 40 orders for one sold-to party (VA05)
- Create an invoice (VF01)

The dialog steps from this benchmark study are presented in Figure 9.11.

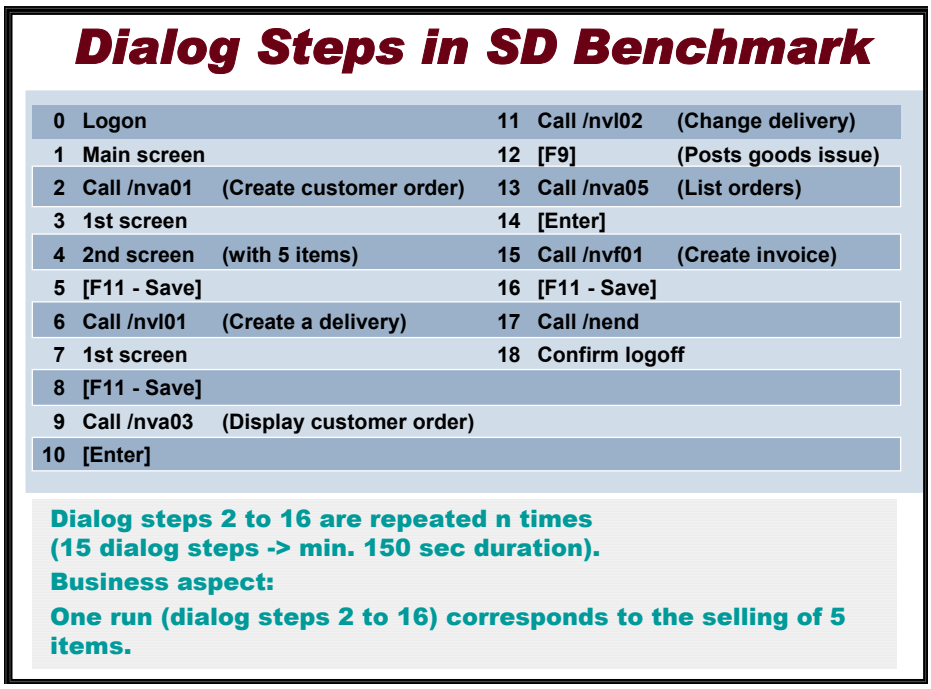


Figure 9.11: Dialog Steps in SD Benchmark

SAP Business Intelligence Scalability

With the emergence of e-business, many corporations are merging their departmental databases into enterprise-wide data warehouses to gain consistent insight into all aspects of their value chains – within and beyond the enterprise walls. The volume and complexity of enterprise data grows with each new supplier, customer, product, employee, and data source. In parallel, booming end-user adoption of business intelligence results in more empowered decision makers at every level in the organization.

Together, SAP and Sun built and successfully tested a system that supported the equivalent of 20,000 users performing hundreds of thousands of operations per hour against more than 5 terabytes of data. The system achieved an average response time of 2.5 seconds in the first test. This is equivalent to 205,384 (356000 ÷ 26 x 15) business questions processed within one hour. In the second test, the evaluation wanted to prove that the system could handle easy and heavy queries at the same time. In a real-life scenario, heavy queries usually result from ad hoc reports that use unpredictable navigation paths that cannot be supported by suitable aggregates. The average response time of an easy query was five seconds. A heavy query, which had to retrieve data by a full table scan on a 146 million record fact table returned results in 5.5 minutes.

The test was audited by Winter Corporation, an independent analyst firm that specializes in very large databases. The test implemented a real-life scenario, one that was almost 10 times larger than the average sizes of the surveyed customers – both in data volumes and number of users – but no technical limitations of the software or hardware were noticed.

Therefore, it can be safely assumed that SAP BW 3.0B can handle data warehouses larger than 5 terabytes.

SAP XI Scalability

The SAP Exchange Infrastructure is highly scalable and accommodates both XML messages as well as native SAP Intermediate IDoc messages for SAP-to-SAP communication. The processes taking place in the runtime of the Exchange Infrastructure, that is, the Integration Server and most particularly the Integration Engine, are most important for sizing. In a nutshell, the Integration Engine is a central 'distribution engine' that processes XML messages, regardless of whether a message was sent to the Integration Engine using an adapter or the Proxy Framework. This includes services for determining receivers (logical and technical routing) and for the transformation of message contents between sender and receiver systems (mapping). The figure below illustrates a single message being transferred through the Integration Engine between two applications. Routing and physical address resolution is only needed for the request as the response is transferred to a sender that is already known. Different kinds of adapters ensure connectivity to business partners, exchanges, third-party systems, and SAP solutions.

Given a message, including the information on the sender and the message interface, the logical routing service determines receivers and required interfaces by evaluating the corresponding routing rules, whether those rules are XPath expressions or Java code. This logical routing can have a significant influence on the overall performance of the Integration Engine. The mapping service determines the required transformations that depend on message, sender, and sender interface, as well as the receiver and receiver interface. In the case of synchronous communication, even the message direction is relevant to appropriately transform input, output, and fault messages. After retrieving the required mapping from the Integration Directory, the mapping service can then either execute XSLT mappings or Java code (or any combination in a given sequence) to the business content of the sender message. Mapping, like logical routing, signifies changes to the data structure and therefore can impact on performance.

Based on an average XML document size of 31 kB, reflecting an IDoc (ORDER01) with four line items (Idoc of 10 kB) and 100,000 messages per hour could use the following representative hardware configuration with a 65% CPU load is equivalent to approximately 2100 SD user in the R/3 Benchmark above. A system that was state of the art in 1997, can now adequately meet the transaction load.

It is also assumed that the inbound adapter converts an IDoc to IDoc XML, starts the Integration Server and then transfers the IDoc XML message. The outbound adapter converts IDoc XML to IDoc format and transfers the IDoc to an SAP component or an external system (subsystem). If none of the pipeline services require the IDoc XML, then one can set a corresponding configuration parameter so that IDocs are not converted to IDoc XML, but are transported as tables instead. This only makes sense if IDocs are to be received on the Integration Server without changes to the data records and sent again as IDocs. By avoiding unnecessary conversions from and to XML can lead to improvements in system performance.

NetWeaver Security

From a security perspective, the US Army Architecture will be relying less on the protection provided by firewalls, routers, and other security mechanisms at the network

level. Collaboration requires the Army to exchange data beyond these secure environments. They will need to create a secure infrastructure within the applications themselves instead of relying on the mechanisms of their internal networks. The individual applications that the Army uses will have different requirements regarding security. Because of this, the appropriate security mechanisms and technologies have to be implemented at the application level. Application security is based on the principles of data security (the prevention of unauthorized data modification and data access), privacy, and auditability.

The security infrastructure of NetWeaver delivers comprehensive security features for the Army Enterprise Architecture environments. It protects business transactions and information within applications and Web services from unauthorized use by addressing the key security issues of authorization, privacy, nonrepudiation, and integrity:

- Easy user administration with a unified user store, typically a directory service, allows the Army to manage user roles and authorizations efficiently.

- Secure system management includes authentication and encryption mechanisms, as well as a secure IT landscape architecture to protect the privacy of server communications.

- Digital signatures provide security and nonrepudiation on the application level by attaching trust information to the data itself – an important aspect when handling processes in the Army's environments.

- Efficient trust relationship management offers authentication, single sign-on (SSO), and impersonation mechanisms, as well as integration of public-key infrastructures, bridging the security gap at the interface between users, systems, and applications.

- A comprehensive audit framework allows users to perform detailed checks on existing security mechanisms and to ensure the integrity of business transactions and data.

Chapter

10 High Level Integrated Schedule

There are multiple initiatives underway within the Army Logistics Enterprise. There are also multiple initiatives within the DOD environment that will affect the Army logistics enterprise. Throughout this report recommendations have been made to integrate the Army's logistics environment and leverage the solutions chosen by the Army. The following sections of this report highlight the initiatives addressed and outline a high level integrated schedule for integrating them into a single Army Logistics enterprise.

Reflected below is a composite view of the integrated schedule. Each of the critical components have been analyzed to ensure the Army leverages from the existing work performed and that it takes advantage of future product capability. The integrated schedule positions the Army Logistics Enterprise to be better prepared for the critical Army transformation that will take place.

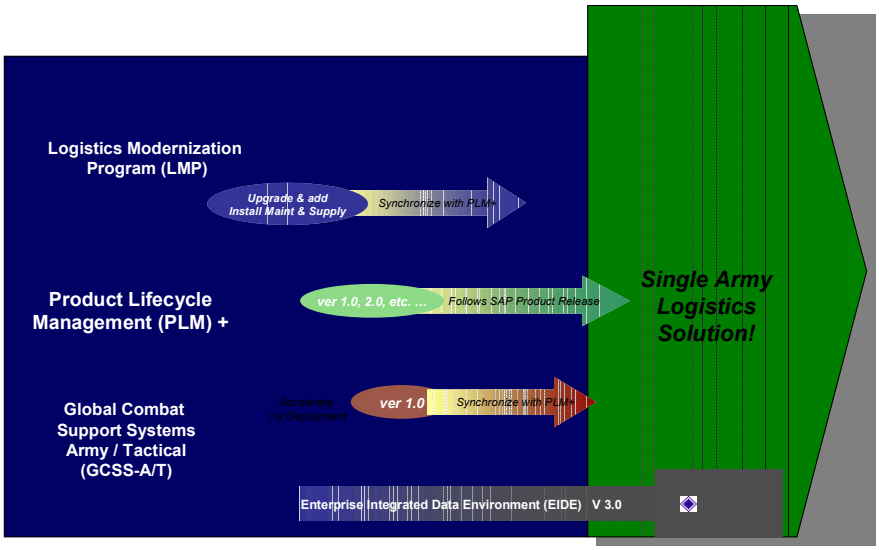


Figure 10.1: High Level Schedule

Global Combat Support System – Army (GCSS-A)

The GCSS-A is a sub-component of the GCSS family of systems, a broader effort aimed at enhancing combat support through system interoperability. The Army system will

[21] This schedule was taken from Integrated Data Environment, Briefing to the Data Standards Working Group by Debbie Greger, IDE Program Manager, 11 February 2003.

eventually be integrated with the national-level modernized logistics system. Specifically, through GCSS-A, the Army will fold the service's 13 legacy logistics systems into an integration domain and interface them with the rest of the Army enterprise environment -- personnel, financial, medical and other non-logistics CSS functions, as well as the external Defense Department environment. The decision has been made to enable the integration domain for GCSS-A through the implementation of commercial standard software. It is important to note that even though the decision has been made to move forward with SAP, this project is still in the planning stages.

Logistics Modernization Program (LMP)

The LMP project requested that a contractor provide application services to replace the wholesale logistics functions supported by Commodity Command Standard System (CCSS), Standard Depot System (SDS), and other specified systems and subsystems. The original tasking has been extended through additional delivery orders, including a significant extension of the application services to include Single Stock Fund (SSF) capabilities. While LMP is a significant enabler of the national integration domain, the original contract was not scoped to leverage the full capabilities of SAP.

SAP projects are initiated to align business process domains with a single integrated software solution. The LMP project was initiated to replace two information systems. If you retire legacy systems and replace them with ERP, you must also replace interfaces to other affected systems. This does not permit the flexibility that the implementation consultants need to leverage the end-to-end capabilities of the software. The same logic applies to GCSS-A. It is currently scoped as a system replacement project; i.e., thirteen tactical systems are targeted for replacement. With enterprise software, scope is defined in terms of business processes, not systems.

Master Data Management (MDM)

For the Army Single Logistics Architecture solution, the management of master data across multiple systems is a critical requirement. The Army has made the decision that one set of master data is the only acceptable solution. The architecture is constructed to accommodate this requirement. Our recommendation is that the SAP Master Data Management (MDM) solution be implemented, since this solution preserves the integration domain while minimizing interface.

The SAP MDM solution is a new component in the NetWeaver solution. Product development for the upcoming release was frozen in February 2003, and the first version the product will be shipped in the third quarter of 2003. The initial shipment will probably be a mature product, but it is limited in that it will not be operational for all data masters; i.e., the first releases will include the customer and vendor masters.

SAP Exchange Infrastructure (XI)

The SAP Exchange Infrastructure (XI) enables inter-system communication in a heterogeneous, multi-vendor technology environment. XI combines traditional Enterprise Application Integration (EAI) technology for communicating with external systems, while using optimized internal messaging across SAP components. This is a key component of the Army's architecture, because SAP Master Data Management Runs on top of XI, enabling master data integration. That is, during distribution, SAP MDM uses XI to transport business objects to predetermined local systems within the distributed IT environment. XI provides unique routing execution, queuing, and format conversion capabilities for the secure transport of objects to their proper destinations.

SAP Business Solutions / Application Components

For the military customer base the complete SAP solution requires a mix of core SAP R/3 as well as other SAP industry solutions. In addition, there is new SAP functionality that addresses the frequent "task reorganization" requirement which occurs for field units in the Army. This "force-element" capability is being developed under a Strategic Development Program (SDP) with the German Bundeswehr and will soon be ready for delivery. This functionality will be incorporated in the EA-DFPS solution. It has been accounted for in the GCSS-A/.T timeline.

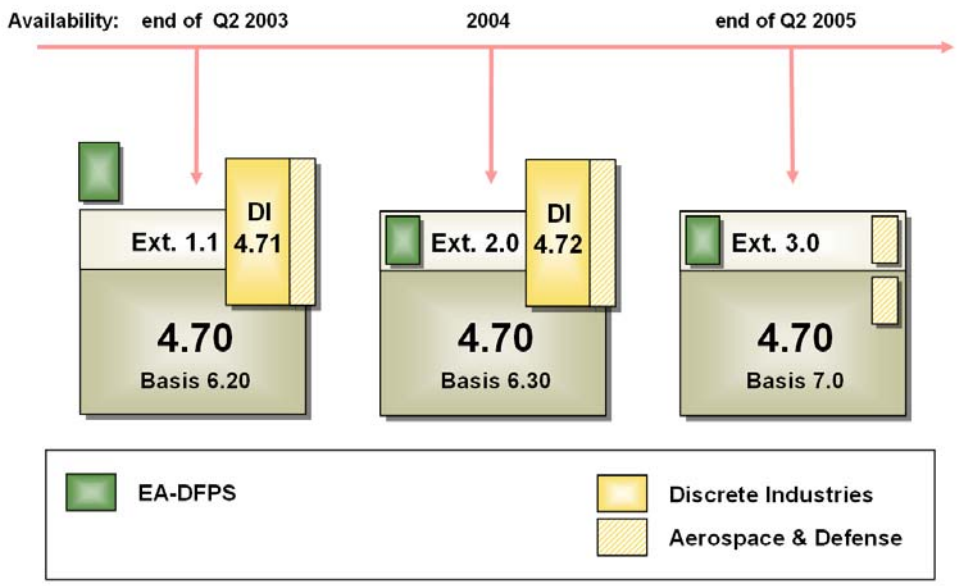


Figure10.2: SAP Product Delivery

Enterprise Integrated Data Environment (EIDE)

The IDE is an Enterprise Application Integration (EAI) entry point into DLA. Versions 1.1 and 1.2 of the IDE are prototype demonstrations, and version 2.0 is a production version, but does not include all log functionality, but version 3.0 will be a production version with all log functionality. Since the Army architecture is focused on implementation, versions 2.0 and 3.0 are critical to the Army.

The Integrated Schedule

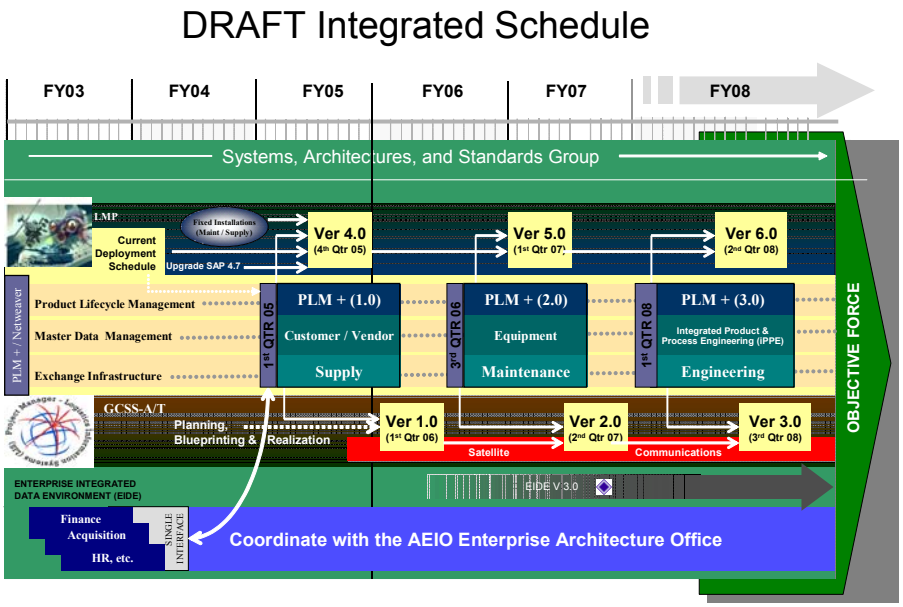


Figure 10.3: Draft Integrated Schedule

Details of the Integrated Schedule:

All of the components outlined in the integrated schedule are critical components to enabling the single Army Logistics Environment. As identified above, to complete the total Army enterprise it will be necessary to coordinate closely with the newly established Army Enterprise Integration Office (AEIO). This study recommends the establishment of a consolidated hub for Army logistics using the SAP/PLM Netweaver solution. The advantages provided by this recommendation can be further enhanced by the inclusion of more functionality through the proposed hub.

As identified above, the SAP/PLM Netweaver hub is a critical aspect to the integrated architecture. We recommend the Army begin the planning process to implement as soon as practical. Since many of the components are not new, but rather a bundling of existing products, the implementation can begin once the planning process is completed. The key schedule driver within the Netweaver product is the Master Data Management (MDM)

component. Since it is a new product, it has been position on the timeline to synchronize with the latest development schedule. This is reflected by "Customer/Vendor" MDM component in FY05, the "Equipment" MDM component in the FY06-07 timeframe, and the "iPPE" component in FY08. An associated exchange infrastructure (XI) of supply, Maintenance, and Engineering has been positioned to complement the MDM capabilities.

The LMP program is currently scheduled to go-live with its 1st deployment of in May of 2003. Two additional deployments are scheduled in August and December in the same calendar year. We recommend that this schedule should not be adjusted. However, once completed, we recommend that a solution upgrade to SAP version 4.7 (R/3 Enterprise) should be performed. This requirement is necessary to allow the LMP to take full advantage of the PLM/+ hub, which will be operating on the 4.7 platform. In addition, during the same release, we have scheduled the scope increase to accommodate the addition of fixed base supply and maintenance into the LMP solution. The remaining releases have been tied to the PLM/+ releases to allow the LMP solution to take advantage of the functionality provided by the PLM/+ Netweaver Hub.

The GCSS-A/T program should begin with the baseline platform of SAP release 4.7 and the EA-DFPS solution. We recommend that the program scope be divided into deployment phases to better synchronize with the SAP EA-DFPS development schedule. An additional benefit of this strategy would also allow for an accelerated 1st deployment. Given the unsuccessful earlier attempts to field a solution, it is important for the current initiative to have a quick "win". One possible approach is to establish the PLM/+ Netweaver solution inside the GCSS-A/T solution. This could provide positive momentum for the program as well as the single logistics solution.

The IDE is an Enterprise Application Integration (EAI) entry point into DLA. Versions 1.1 and 1.2 of the IDE are prototype demonstrations, and version 2.0 is a production version, but does not include all log functionality, but version 3.0 will be a production version with all log functionality. Since the Army architecture is focused on implementation, versions 2.0 and 3.0 are critical to the Army. The documents associated with version 2.0 are procurement sensitive, so a complete architecting of the Army relative to the IDE is impossible at this time; e.g., at the operational level inclusion in the Army architecture requires an understanding of:

- The business processes that are enabled by Versions 2.0 and 3.0,
- The technical standards that are supported by Versions 2.0 and 3.0, and
- The estimated implementation schedules for Versions 2.0 and 3.0.

The objective of the IDE is to "provide an enhanced environment that enables the DoD Logistics Enterprise to execute practices, processes, applications and decision support tools to achieve logistics interoperability and allow for information exchange within and between internal and external DoD business partners." The IDE will be the single point of entry to the DLA SAP solution for Business Systems Modernization.

The precise alignment with the IDE is uncertain at this time. Since PLM+ and the IDE are still concepts as opposed to production systems, alignment can only be approximate. For this document, we use the IDE schedule that was presented to the Data Standards Working Group on 11 February 2003. This schedule is reproduced as Figure 10.4.

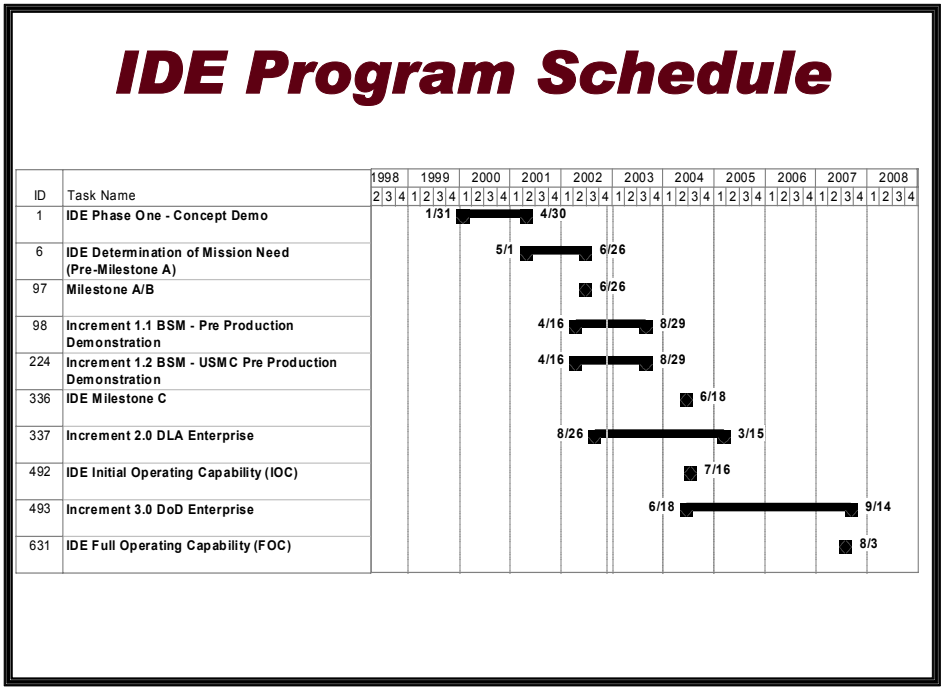


Figure 10.4: IDE Program Schedule[22]

For the Army, the critical date August 2007, which is the date of full Logistics capability for the IDE. The Army's PLM+ hub must be aligned with this schedule.

[22] This schedule was taken from Integrated Data Environment, Briefing to the Data Standards Working Group by Debbie Greger, IDE Program Manager, 11 February 2003.

Chapter

11 Institutionalizing the Architecture

The Army logistics architecture documents the requirements of a complete SAP solution as defined by SAP's defense customers, and it provides an accurate documentation of how Army logistics aligns relative to the SAP solution. Hence, one can use the documentation to support decisions from a position of complete information, and the business process architecture can be used in the future to manage (monitor and document) the implementation. It represents the agreement reached by all key stakeholders, and it documents where you are going in much detail (i.e., all the way to the transaction level if one is willing to capture that level of detail). The architecture is the "build plan," and it is up to the Army to analyze, update, and enforce the plan. The next section provides some detail as to how the architecture should be used by the Army.

SAP Methodologies and Tools

Value SAP

Standard SAP Implementation Documentation

With SAP implementations, detailed project documentation is produced during all project phases. If one strictly follows SAP's recommended methodology, the project scope information is stored and managed in the Q&Adb. For example, in the Blueprinting Phase the consultants lead interviews or construct models to document project scope. Once the scope information is stored and analyzed in the Q&Adb, a macro is executed that generates a Business Process Master List (BPML), which is a first approximation of transactional scope (i.e., the business processes to be included in the implementation as well as the SAP transactions that are enabled by these business processes).

In reality, the process is never so pure. Consultants have adapted the Accelerated SAP (ASAP) methodology to meet their own needs, and it is often the case that the Q&Adb is never fully populated. If the information is stored in the Q&Adb, it is comparable across projects; i.e., it is mapped to the SAP reference hierarchy and is displayed in a consistent format. This permits a common analysis across the multiple projects.

Accelerated SAP

SAP's recommended implementation methodology for SAP implementations is called ASAP (Accelerated SAP). ASAP is an implementation roadmap combined with tools that are called accelerators. ASAP consists out of 5 phases:

- **Project Preparation**
  provides initial planning and preparation for the SAP project
- **Business Blueprint**
  achieves a common understanding of how the company intends to run its business within the SAP System
- **Realization**
  implements business and process requirements based on the Business Blueprint
- **Final Preparation**
  finalizes the readiness to go live
- **Go Live and Support**
  moves from a pre-production environment to live production operation

This methodology works fine for average sized SAP implementations, and all major consulting companies adapted ASAP as part of their SAP implementation frameworks. ASAP was also build to have one implementation team within one organization. ASAP is not able to align multiple dependent implementation efforts.

Global ASAP

For bigger implementations, there is usually the need for a multi tier implementation; i.e., a replication-based roll-out scenario. SAP's methodology for supporting this scenario is called Global ASAP. With Global ASAP, a central department builds what is called a Global Blueprint[23]. This Global Blueprint is a fully configured SAP solution. This global template will be rolled out to sub organization by building local variants. Every local implementation is supposed to follow the ASAP methodology.

- **Global Program Definition**
  initiates a global implementation and management program
- **Global Business Blueprint**
  builds a template of the global business and process requirements
- **Global Realization**
  implements business and process requirements based on the Global Business Blueprint
- **Global Maintenance and Support**
  provides global maintenance and support for sites where R/3 is in production

[23] The Global Blueprint is sometimes called a Global Template.

Global ASAP is not really meant to be the implementation methodology to apply to large companies. It is designed for companies that have similar business in multiple locations, e.g., a global distributor with multiple subsidiaries.

ASAP and Global ASAP have been used by many companies, but as noted, ASAP has limitations for large organizations. Also, since ASAP and Global ASAP are not formally connected to SAP's software solution, controls that apply directly to the software are missing. That is, SAP has no direct way to monitor the implementation to ensure that appropriate implementation steps are being applied, as suggested by the software provider. To address the deficiencies, SAP has introduced a new implementation product that is called the Solution Manager.

SAP Solution Manager

Overview

SAP® Solution Manager is a platform that provides tools, integrated content, and procedures needed to implement, support, and operate an enterprise's mySAP.com solution. The Solution Manager is NOT a new version of ASAP. It is a new approach for managing SAP implementations, and it extends previous implementation concepts. The Solution Manager focus is not only on SAP R/3, all SAP products.

The Solution Manager retains some aspects of the ASAP methodology and the supporting tools, but the Solution Manager assumes the role as the onsite platform to support key implementation activities. In fact, It is the SAP implementation portal.

The Solution Manager helps to:

- Ensure that the Business Blueprint will be configured, tested and monitored,
- Understand events that occurred during the implementation project,
- Ensures that the right deliverables are built at the right time during the project,
- Monitor the implementation progress,
- Organize configuration and testing in a complex system landscape, and
- Manage and compare configurations across systems

Figure 11.1 indicates the phases in which the solution manager is used during the SAP implementation life cycle.

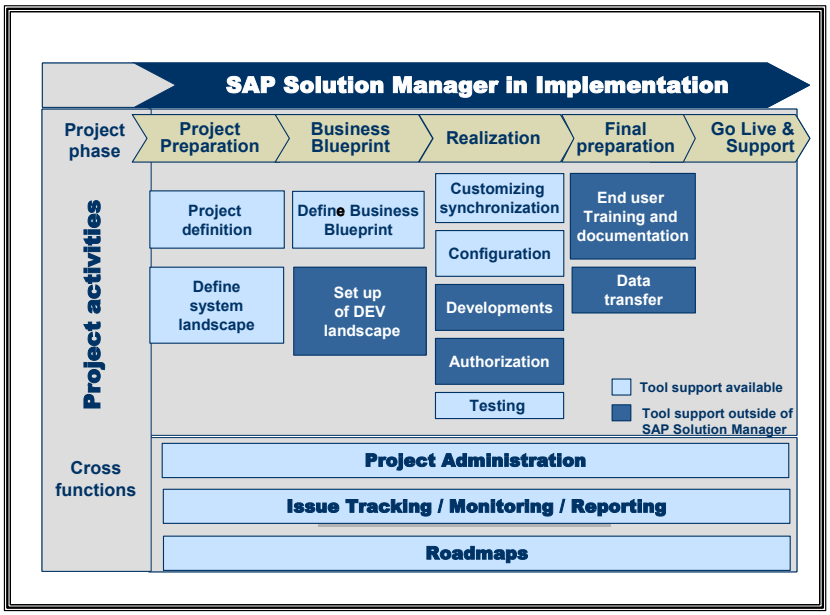


Figure 11.1: SAP Solution Manager in Implementation

The Solution Manager is an implementation portal, providing all necessary implementation tools. It also integrates the deliverables to improve implementation results, while allowing the team to reuse outputs from earlier phases as input for following phases (e.g. the blueprint is integrated into customization as well as into the testing). The portal itself looks like an implementation roadmap, which makes it easy to use as an implementation methodology. The Solution Manager implementation portal is presented in Figure 11.2.

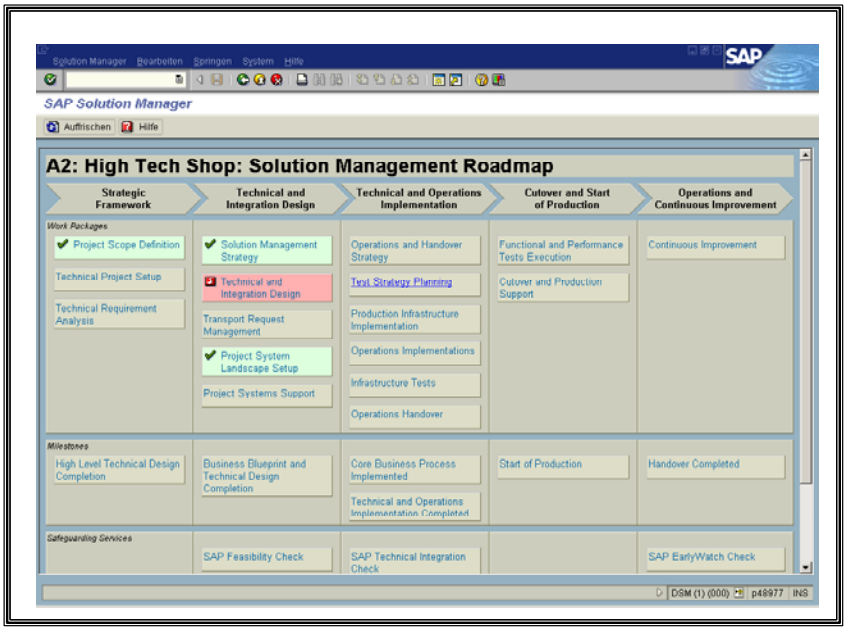


Figure 11.2: Solution Manager Implementation Portal.

More Tool than Methodology

Value SAP (i.e., ASAP and its supporting tools) was a stand-alone software solution. You used Value SAP on one computer while you installed the R/3 software on another. There was nothing wrong with this approach, but by working in separate systems, it was impossible to have close integration between the "installation" and the system. The ASAP methodology and tools captured all aspects of the implementation process, but still required significant external management during the implementation process. At the end of the implementation, you were never sure that the design was realized, much less what was tested and operated.

The Solution Manager attempts to close this gap between planned implementation and realized implementation by integrating the deliverables across phases. The gap closure is aided by the fact that the Solution Manager is built into the SAP software solution.

Furthermore Solution Manager utilizes and fully integrates other SAP components, such as

- Knowledge Warehouse (Document Management),
- eCATT (Automated Test Tool),
- Configuration Management and Transportation, and
- System Monitoring.

Blueprinting is managed and documented from inside the Solution Manager. The Blueprinting screen is reproduced in Figure 11.3.

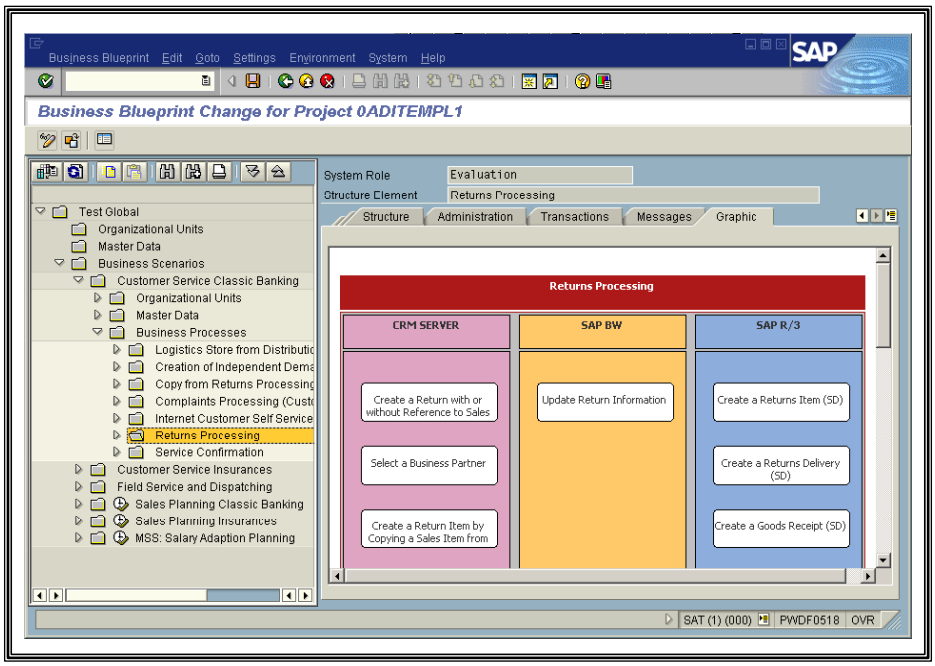


Figure 11.3: Blueprinting Screen form Solution Manager

SAP has made an important change from ASAP as it was implemented in Value SAP. In Solution Manager, the Business Processes, Organizational Units and Master Data are

fully integrated within one scenario, which makes the transition between blueprint and realization much smoother.

Tools vs. Methodology

An ERP implementation is a broader effort than the configuration of the selected ERP software. Change management, business process improvement, training, and other important components are a part of a successful implementation.

A methodology provides guidance on "how to get there," while implementation tools support "what is delivered." The challenge is to bring the two concepts together effectively. The Solution Manager is a tool; it is not a methodology for an ERP implementation. Solution Manager supports the technical aspects of the implementation and aligns the technical aspects within a roadmap type of portal.

Recommendation

We do not recommend that constraints be placed on any methodology used by the integrators. However, we do suggest that the Army select the tools that are used during the implementation. We recommend the Solution Manager, because it provides better control by the customer and it facilitates monitoring implementation progress against the architecture. Furthermore, it is SAP's recommended approach for implementing their products.

The Solution Manager

- Is the new standard SAP implementation product,
- Is the manufacture's tool to "install" the software,
- Produces standardized project deliverables, and
- Allows standardization, visibility and management across ERP projects.

The Solution Manager allows the customer to receive and own the deliverables and to enable the reuse of the implementation results for the future.

Product Rollout

The current version of Solution Manager is 2.2. Solution Manager 3.1 has been released in a ramp-up phase and will be available in quarter three of 2003. There is a migration strategy from previous ASAP versions as well as from Solution Manager 2.2. We recommend that the Army implementation team begin with Solution Manager 2.2 instead of the ASAP 4.6c release. Since both products have similar implementation concepts, it would be technically possible to reuse information built in ASAP, but this change of concept in mid-implementation would be a difficult change for the implementation team and would probably delay the project. The implementation schedule is depicted in Figure 11.4.

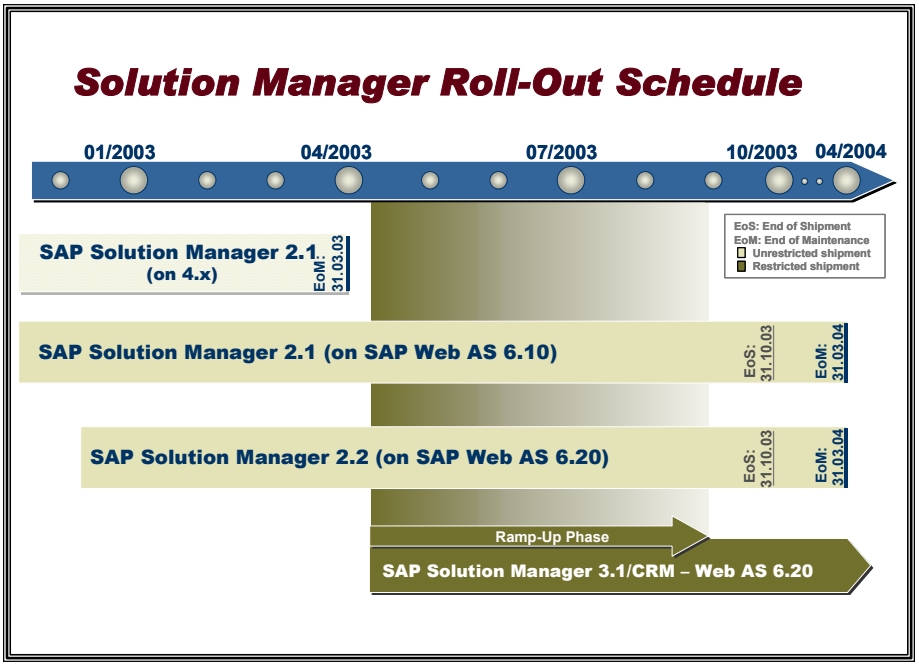


Figure 11.4: Solution Manager Roll-out Schedule

ARIS for mySAP

The information stored inside the Q&Adb or in the Solution Manager is only project related and not meant to be the Enterprise Architecture. The implementation oriented SAP reference structure is not sufficient enough to also meet the needs to have an integrated enterprise wide architecture of an organization that is the size of the Army. The SAP blueprint is too detailed, and it does not document the overall solution.

The ARIS Collaborative Suite is a tool that will allow the Army to integrate project information from the Q&Adb with the Single Army Logistics Enterprise architecture. The ARIS Collaborative Suite allows the integration of both information sources in combination with a project-wide focus for implementing the Army's Business Project Architecture.

The approach using the ARIS software has major advantages over paper-based documentation from drawing tools, such as Visio. Since ARIS operates directly on the Q&Adb or the Solution Manager, all documentation is precisely linked to the SAP standard. That is, since the business functional scripts are mapped at the transaction level, the resulting solution maps and business process models are directly related to each other, as well as the SAP software. This provides a precise view of business process scope relative to what has actually been configured by the project teams. Since all documentation is stored in a repository, changes are immediately reflected across all business processes and other views. For example, if an object is contained in 10 business processes in multiple organizational views, a single change to the object is immediately reflected in all views where that object occurs. This is in direct opposition to drawing tools (like Visio) or file based tools (like Popkin), where each drawing that contains the object must be manually updated. If all ERP projects used the same methodology, and all are

mapped to the SAP reference model, unambiguous comparisons across the projects are directly possible. This is a critical requirement for designing and maintaining a Single Army Logistics architecture.

Even with all of the advantages of modern tools, manual effort is still required to derive the architectural end state. For example, if there is documented business process overlap across some of the projects, one still has to make decisions about how the overlap will be resolved. In our terminology, this process of business process gap analysis is called "business process normalization." The approach is not perfect, but at least the organizational architect knows that an overlap or gap exists, and it is possible to analyze the implications of various resolution strategies.

In summary, there is no "silver bullet" for resolving business process requirements against configuration documentation for complex enterprise initiatives. In the end, the senior executives must understand the critical issues, including the implications of resolving one way versus another. Finally, someone has to make the difficult decisions that define business process scope that bounds the configuration. The architecture only provides documentation to support that decision.

Guide to Enterprise Architectures

The Business Process Architecture

Business Process Architecture Justification

This section focuses on how the BPA relates to the SAP implementation in the US Army and customer-mandated extensions, whether they are packaged or legacy. The objective of the section is to provide a justification for maintaining a BPA to help with the logistics implementation project. To obtain maximum long-term benefits from SAP, the Army must understand and manage its cross-functional business processes over the complete system life cycle. Configuration never ends as extensions and upgrades are continually executed. Future business processes must be configured so that they leverage the current investment in SAP by adding maximum value (in terms of products and services) to the fleet. This achievement of this ongoing objective requires discipline, business process documentation, organic SAP configuration expertise, configuration management capabilities, ongoing testing, and continuous training.

So, why document and maintain the business process architecture in an enterprise repository? The answer is straightforward - You cannot properly configure a business process in SAP unless you understand it. Since modern business processes are cross-functional, multiple stovepipes are spanned. Hence, documentation and agreement among process owners and configuration teams are essential. This last point is one of the most overlooked benefits of a BPA. If the senior executives do not agree on enterprise scope prior to project initiation, the configuration teams cannot properly configure the software. Total agreement must be reached on enterprise business scope prior to moving to the project realization phase.

For upgrades, reworks, and extensions, the repository is the configuration baseline. Without the repository, the organization is constantly creating and realigning diverse documents and drawings to support required ongoing activities, and there is a high cost associated with re-creating project details that were not documented while executing the ASAP methodology. The management and enterprise systems literature is clear on the previous point, and the experts should not be ignored.

So, why not document using Word, Excel, and drawing tools (such as Visio)? Again, the answer is straightforward. You cannot maintain business process configuration in a drawing tool with linked Word document descriptors. A change in one business process object is often reflected in many places; making configuration management almost impossible with drawing tools. Drawing tools are used when there is no requirement to manage over time; i.e., a one-shot quick-use requirement. For ERP projects, there are ongoing changes; hence, an architectural repository is an absolute requirement. The engineering literature is clear on this point.

How Should Business Process Repository be used?

To understand the issues that surround usage, additional discussion is required. The following argument is often used by consultants to discourage the creation of a business process repository in the SAP environment: "The business processes are embedded in the software, and documenting these processes in a repository results in unnecessary additional work." This logic is faulty for the following reasons:

- If the project is simple with no unusual aspects, then one could argue for a rapid implementation with minimum documentation. That is, if the consultants are implementing the discrete manufacturing model for the 25th time, and there are no unusual aspects of the 26th implementation, and if rapid implementation is the ONLY objective, the quick approach is tempting. However, DoD implementations do not fall in this category. The implementations are complex, and the DoD is making the FIRST attempt to align commercial business processes with its organization. Certainly, an ERP solution where multiple organizations intersect with very complex requirements is not a candidate for rapid minimum-documentation methodologies. There are too many overlaps, gaps, and unresolved issues that require study and agreement before significant money is spent on consulting services.

- As previously mentioned, if the implementation is routine, with no additional changes (i.e., upgrades) or extensions (e.g., Supply Chain/Customer extensions), then perhaps a business process architecture would not be needed. However, the software and its extensions are continuously evolving, and the implications of these changes must be understood and managed.

Hence, the primary benefits of a business process repository are realized over the long-term as the extended enterprise integration environment evolves. The business process architecture is used as follows:

1. The business process architecture is the agreement with the consultants on requirements and scope. It is the build-plan, constructed independently by the Army, and any deviations (scope creep or de-scoping) must be justified. In some

respects, it is a documentation of the scope of work that the consultants must deliver in order to meet contractual agreements.

2. The business process repository documents the agreements on what will be configured and how it will be configured. Without agreement, endless high-level meetings and configuration re-work is almost guaranteed. The first rule of ERP is that configuration does not begin until the scope is "fixed." The ERP BPA documents this fixed scope for future reference a project management.
3. The business process architecture is used to compare the business process change implications of moving to future versions of the SAP software. The existing business process architecture is the baseline for any additional configuration that may be required.
4. The business process architecture is used to understand the implications of extending the SAP solution with extensions, product data management (PDM), business-to-business (B2B) solutions, customer relationship management (CRM) solutions, legacy interfaces, etc.
5. The business process architecture is used to support training for transmitting the implications of all configuration decisions to Business Process Executives and other managers, super users, and users. The benefits of a common documentation repository are obvious for this item.
6. The business process architecture is used to maintain interface and software configuration control. With SAP this is accomplished through the interaction of three critical and related tool environments:
    - The SAP Q&Adb or Solution Manager,
    - The architecture repository, and
    - An enterprise-quality document management system.

    These three environments must be seamlessly interoperable.
7. The business process architecture is used in conjunction with the system and technical architectures for future documenting and planning for maintenance and continual retesting.

The main points of this section are summarized through a sequence of questions and answers.

Why Develop and Maintain a Business Process Architecture?

Answer: Accurate and consistent across-project documentation is needed to support project planning, implementation, and problem resolution. On a pragmatic level, it is almost impossible to maintain business process configuration in a drawing tool or a descriptive text document. Business process objects are shared across business processes, and change in one object is often reflected in many places. Drawing tools are used when there is no requirement to manage over time; i.e., a one-shot quick-use requirement.

Is a "complex" tool needed?

Modern organizations are complex, and the DoD is no exception. Business processes are complex and cross-functional in nature. The information systems (e.g., SAP R/3) that support the business processes are complex. It is amusing that some organizations will spend $100s of millions on an industry leading packaged software solution (like SAP R/3), but they try to manage their ongoing environment in a drawing tool, or a tool that every independent analysis considers to be inferior. If an organization selects the "best" ERP solution, why would the same organization consider inferior tools, basing the decision on information that is selected from marketing presentations or the vendors' web sites? Implementing organizations need to pay close attention to the independent studies and invest in the training that is necessary to leverage management solutions for maximum benefit. The management and technology literature is clear on this point.

Architecture Tools

Overview Architecture Tools

Business process documentation is more than depicting the time-ordered sequence of events and functions that define business process procedural steps. Other "objects" should be linked to the organization's business processes and managed over time. Critical objects for inclusion are organizational units, systems, data clusters, and eventually data models for legacy systems. For the Army, these "views" should be documented and managed using the language of SAP, since the Army wants to leverage its investment in SAP.

This leads to a key point: Legacy architectural documentation frameworks, such as CIMOSA, PERA, GERAM, or Zachmann, are not capable of documenting in accordance with the required business process structure of SAP, since their focus of integration is not the business process. These legacy architectural frameworks were designed to manage IT/IS resources from an activity- and data-centric point of view, and were not designed to support business process oriented ERP solutions. The data-oriented frameworks are implemented in various documentation tools, some of which are used by the DoD to support software development projects. For example, BPWin and ERWin are implemented from the CIMOSA point of view, using an IDEF-like non-integrated structure, while PTECH's Framework is a generalization of the Zachmann framework.

This discussion is not a criticism of these approaches and their associated tools, but as the independent studies have noted, these focused tools are niche players, and in general, of limited value in support of ERP implementations. These tools do not have a dominating business process view, because they were designed for purposes other than supporting complex SAP implementations. Superior solutions exist, and they should be utilized. In most cases, the legacy tools were designed to support software development projects and not the implementation of commercial packaged software solutions.

It is understood that drawing tools (such as Visio) or process modeling tools (such as SIMProcess or Intellicorp's LiveModel) cannot meet the repository requirements of an ERP architecture. They can document business process steps, but they can't handle data flows, system linkages, data clusters, or models that are required in a true repository. In addition, their configuration management, document management, Web publication, modeling, and report generation capabilities are limited.

Data modeling tools that are capable of documenting information system processes[24] should not be considered. These tools were designed to support the design and development of information systems. With SAP, the data models are purchased and suppressed from the implementation team on purpose. In fact, one primary advantage of packaged software is that the implementation teams are not burdened by data modeling complexity. The SAP data models were developed by SAP and they are used to support the design, development, and testing of the R/3 software solution and its extensions. Since data modeling is not required to support SAP implementation, tools such as ERWin, IDEF1x, and others that are data-centric, focusing on logical dataflow and software processes, are not useful. Not only are the approaches inconsistent with the business process orientation of SAP, they are used primarily to support software design and development as opposed to implementation and configuration.

Other methodologies and supporting toolsets, as indicated by the Gartner Group [Kleinberg (1997)], are more appropriate for the Army's ERP environment. The ARIS solution [Scheer (1998, 1999)] that was selected by the Army is completely integrated with SAP and is the dominant industry leader. It supports all repository requirements and is consistent with the C4ISR Architectural Framework.

The Architecture of Integrated Information Systems (ARIS)

ARIS [Scheer (1994)] does not have the limitations of the previously described frameworks and models. The ARIS Collaborative Suite offers a complete set of object-linked views and is capable of supporting more than 150 modeling techniques. Hence, ARIS is a meta-tool. The following is a subset of the benefits that are offered by ARIS:

1. When an object is modified, the effects are reflected throughout the enterprise in all views; i.e., business process, function, data, organization, and output. The tool is completely object-linked and consistency across views is maintained in the object repository.

2. The ARIS framework integrates around business process and it is also fully embedded into the documentation methodology of SAP. This integration is complete, since ARIS was used to develop the business process reference model for SAP R/3[25].

3. ARIS is completely multi user capable and also Web enabled (viewing and modeling)

4. Report generation flexibility is guaranteed through integration with Microsoft Office.

5. ARIS is voted the number one product by the Gartner group since 1997.

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[25] This difference is noted in the business process management literature. Business process modeling is distinctly different from information systems process modeling. The two concepts have been widely confused, especially by IT/IS professionals, and especially in the US Department of Defense. Business processes have an explicit and dynamic process flow, while information system process models may be dynamic with respect to data flows, but static with respect to time sequencing. $IDEF_0$ is a good example of a static IS process modeling methodology. Because of this confusion, IT/IS professional often use system design tools to support business process analysis, an area the tools were never intended to be used.

[25] See Jost, et al. (1991), Jost (1993), and Nüttgens (1995).

(See also Appendix B – The ARIS Framework)

The Army Enterprise Architecture

Objectives

The Army's objective was to build a high level business process architecture that defines a single logistics solution.

The constraints placed on the architecture development team were the following:

1. For decision support, the architecture results must be presented so that senior management can easily understand the choice of alternatives and the implications of recommendations.

2. For implementation support, the results must be presented at a level of detail that is technically precise, enabling support for new scoping or configuration decisions.

The key to understanding the architecture is the shift from a function-oriented view on various software instances to a business process-oriented view across the physical boundaries of the software. The developed business process architecture is therefore the basis for a business process-oriented realization of a Single Army Enterprise solution.

Levels of the Army Enterprise Architecture

The Army is complex, so the architecture must also be complex. To manage the complexity the Architecture was built in multiple levels. The levels were built in a top down approach, which means the lower the level, the greater the details. All levels are fully integrated inside one architecture repository. This facilitates analyses of impacts to the overall architecture before making an actual change on the implementation project.

Figure 11.5 shows the four levels of the Architecture. The pyramid in the figure also implies that the amount of information grows with the level of detail that is included at lower levels.

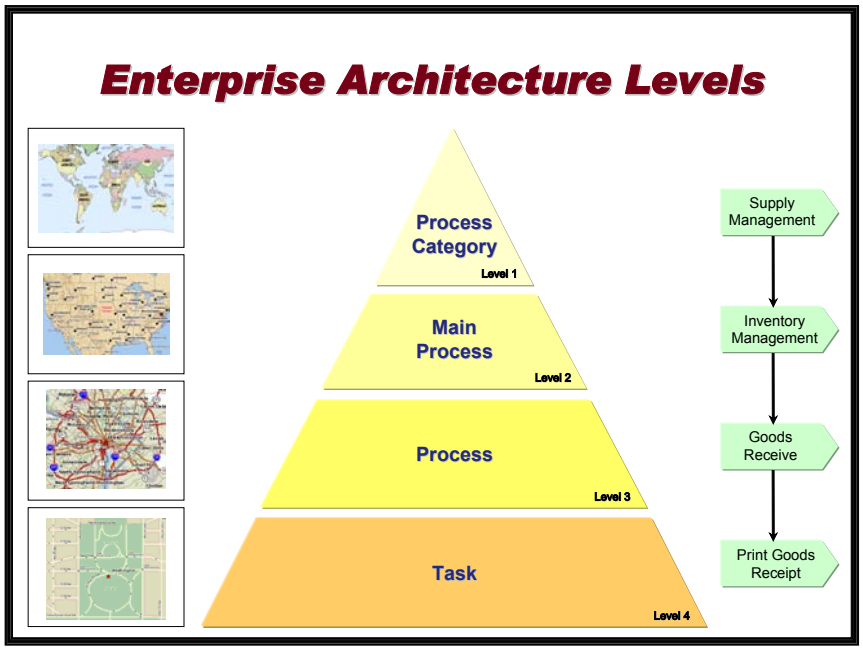

Figure 11.5: Levels of the Army Enterprise Architecture

Business Process Category

The Single Army Enterprise is built from business process categories. The high level operational view (OV-1) provides an overview of the relevant "process categories".

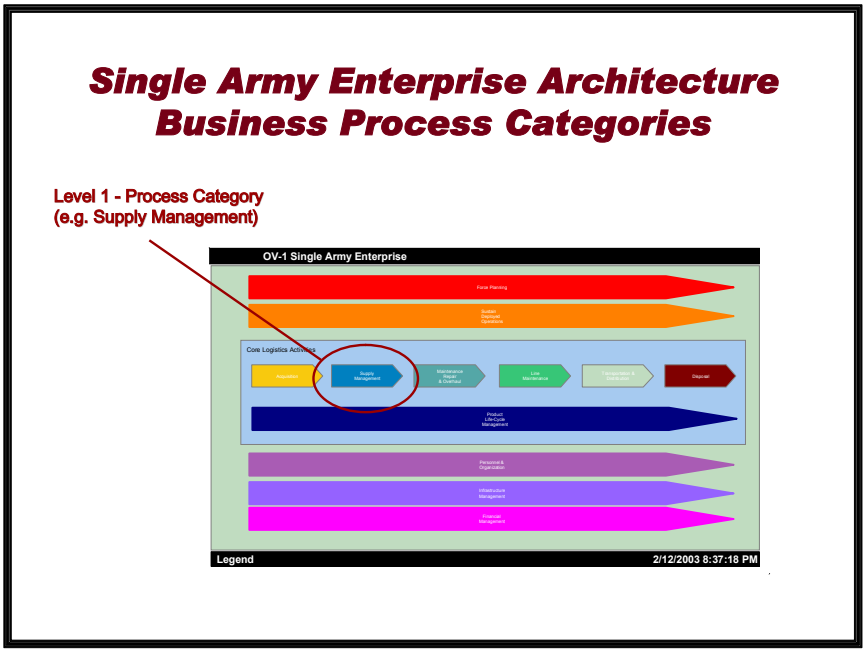

Figure 11.6: Business Process Categories

So far, we have identified 14 “Process Categories” for the Single Army Logistics Architecture during the study: The categories are summarized below.

Command Process Categories

- Force Planning
- Command & Control

Logistics Process Categories

- Acquisition
- National Supply Management
- National Maintenance Repair & Overhaul
- National Line Maintenance
- Field Supply Management
- Field Line Maintenance
- Product Life-Cycle Management
- Transportation & Distribution
- Disposal Management

Supporting Process Categories

- Financial Management
- Infrastructure Management
- Personnel Management

Main Process

Each “process category” has been documented with a detailed process flow description. The process flow shows how the different “main processes” within one “process category” are integrated. The documentation also shows the operational sequence and the flow of data among the main processes as well as the interfaces to other “process categories”.

The C4ISR business process view is used to describe the operational sequence of the “main processes” and the timing that identifies the business rules that constrain the operation. In C4ISR terminology, this is the OV-6ac view.

The selected example in Figure 6, “ Supply Management” contains four “main processes”:

- Materiel Requirements Planning,
- Supply Management & Procurement,
- Inventory Management, and
- Hazardous and Special Materiel Management.

Figure 11.7 shows an example of the OV-6 containing the process flow between “main processes”. The top and bottom areas in Figure 7 are the business process interfaces to other “process categories” like “Field Supply Management”, “Transportation & Distribution” etc.

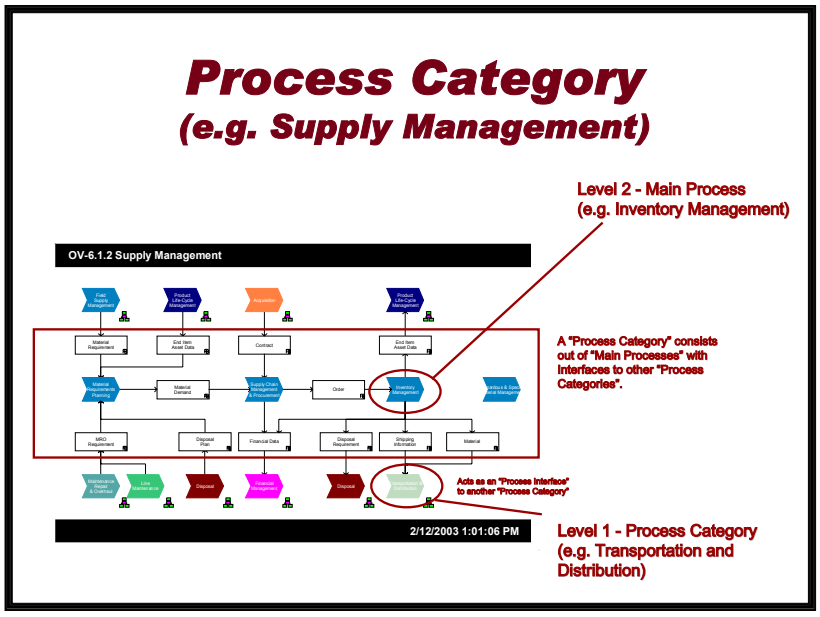

Figure 11.7: Example Business Process Category

Process

Each “main process” is decomposed into lower-level “processes”. A process is the lowest level in the Single Army Logistics Enterprise architecture. The processes are presented as OV-5 activity models. As an example, Figure 11.8 depicts the “processes” for “Inventory Management;” “Order Processing,” “Warehousing,” etc.

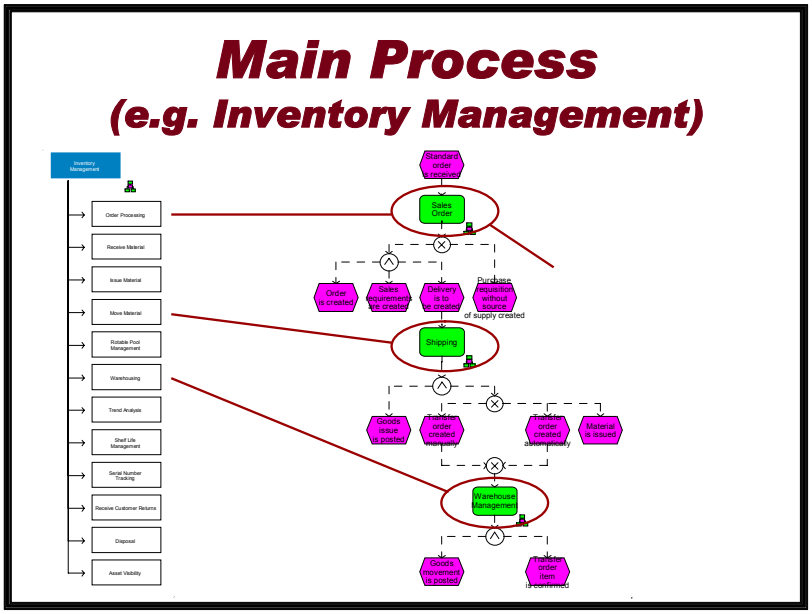

Figure 11.8: Example of a Main Process (e.g. Inventory Management)

The implementation project teams will define the business process flows and the integration of the business processes as they define the blueprint on the projects. Of course, some reverse engineering may be required for the LMP project, since blueprinting was completed some time ago. During the blueprint, the OV-5's are used to build the OV-6's based on the specific business requirements. That is, the OV-5 activities are static, and they do not contain the business process sequencing information that is required by SAP. Hence, the activities must be augmented with sequencing information as well as process logic to convert the OV-5 presentation into true business processes.

Task

The next level of detail when decomposing a business process is a "task". A task is the lowest level in the enterprise architecture. A task is a single action performed at the lowest level of granularity; e.g., like "print goods receipt".

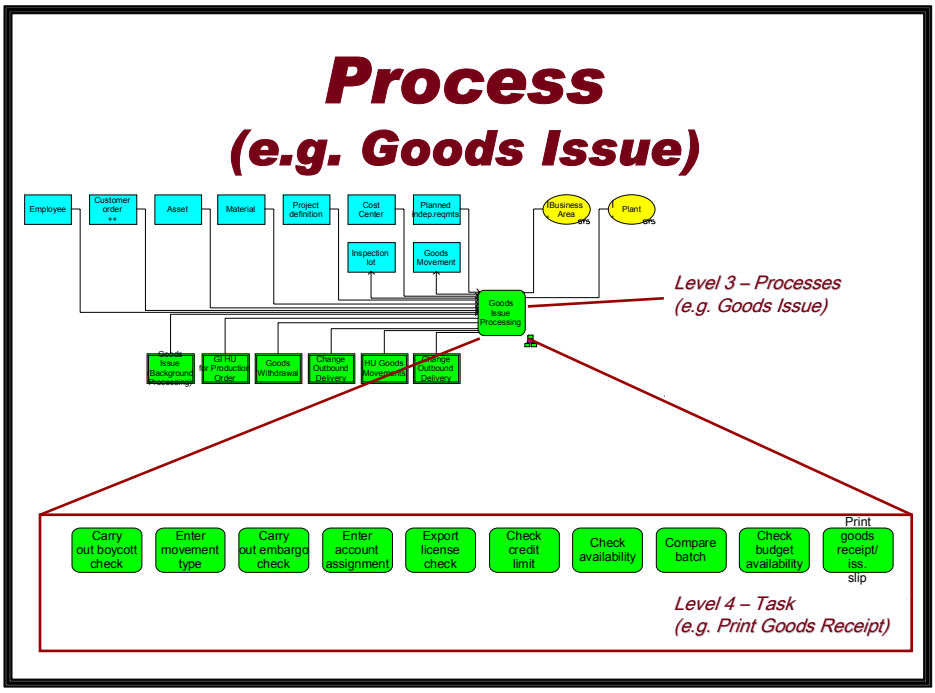

Figure 11.9: Process with Task Decomposition

Figure 11.9 also shows the required input and the produced output by a process as well as the supporting SAP transactions to perform the tasks.

Project Blueprint vs. Enterprise Architecture

The blueprint for an implementation project only delivers one piece of the Enterprise Architecture. In the case of multiple projects (which is the case for the Army), the results of each implementation project are reused to complete or extend the Single Army Logistics Enterprise Architecture. This concept is depicted in Figure 11.11.

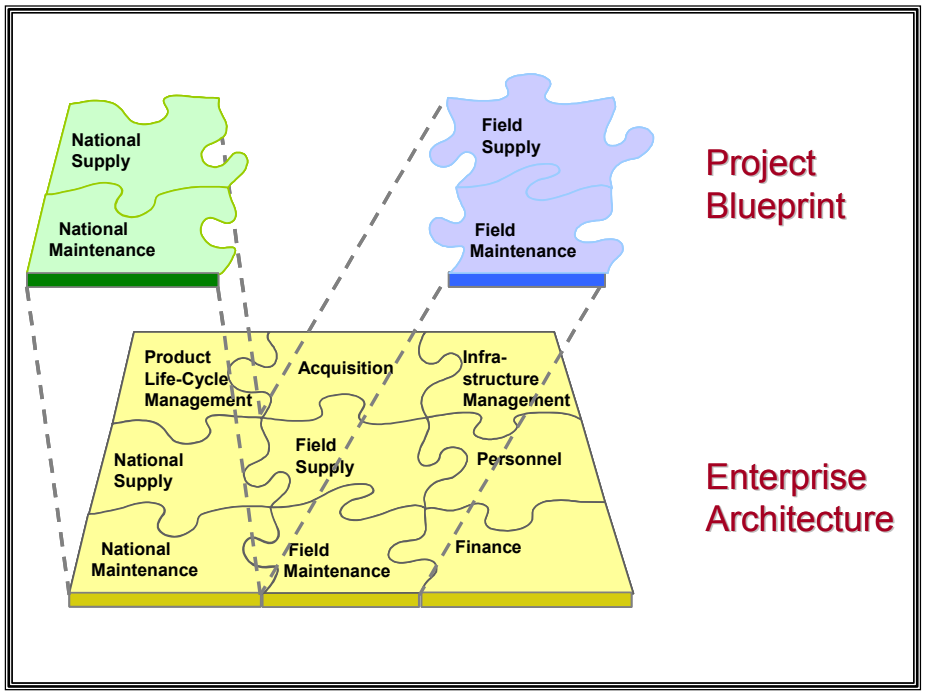

Figure 11.10: Enterprise Architecture Constructed from Project Blueprints

What project information is needed?

During the implementation of an enterprise system, two different kinds of documentation are created. One type of the documentation is pure project documentation like status control, project plans, briefings etc. On the other side, there is documentation that describes the delivered solution; e.g., the blueprint, training materials etc. From an enterprise integration perspective, only the solution documentation is relevant for maintaining the enterprise architecture. This also expresses the importance of standardizing the documentation across projects, since reusability is critical.

Institutionalizing the Architecture

Government Oversight for Managing an SAP Implementation

The business process owners are responsible for defining requirements, and the business teams are responsible for delivering against these requirements. The delivery is executed using an implementation methodology, which includes scoping, blueprinting, configuration, data conversion, integration testing, and finally going live. The requirements should be constantly tracked against scope and the configuration progress. While traditional project planning is important, the uniqueness of enterprise software implementations requires extra attention. This oversight and monitoring is the government's responsibility, and the implementation consultants and the software solution provider have a direct conflict of interest in providing program oversight.

The business process architecture can be used to monitor scope creep and configuration progress against requirements. All projects should be required to provide the requested documentation to support this activity. Since most documentation is readily available, this only requires a regular schedule for the reporting to the group that is responsible for maintaining the architecture.

Finally, the documentation could be provided to higher levels in the DoD to support policy requirements, and to demonstrate that solutions are compliant with particular guidance. Examples abound, but one current example is FMEA compliance.

Support for the Business Teams

Business process workshops are used to resolve configuration issues on implementation projects. The planned business process is studied relative to the SAP software, and a business process is selected for configuration. The configured process is maintained in the business process repository, and it is later used to support training. Any studies or other issues that require documentation for resolution can be supported by the business process architecture.

In addition, as the DoD reference model is developed, it can be documented in the repository. This reference model would include the business rules to ensure compliance with DoD policies and regulations. This reference model could be studied relative to the SAP reference model and target business process architectures. Again, agreement would have to be reached in workshops, but a least a baseline would now exists for supporting such agreements.

Support for Senior Management

The business process architecture is management's implementation guide. Solution maps can be used to present program scope and configuration progress in project reviews. The architecture itself suggests discipline and adherence to good management practices, while demonstrating that the implementation teams have a plan that meets the needs of the Army.

Strategy, Architecture and Standards Group (SAS-G)

Complex Enterprises

The Department of Defense is the largest organization in the world

- 1.4 million active duty personnel,
- 654,000 civilian personnel,
- 6,000 locations,
- 146 countries, and a
- $371 billion budget.

The U.S. Army is the oldest and the largest military department within the Department of Defense. It is unreasonable to believe that a commercial best practice implementation roadmap would be appropriate for the U.S. Army. The implementation is unique, and there is no best practice. The only comparable implementation (from a best practice point of view) is the German Armed Forces. Also, for a number of reasons, the German best

practice approaches could not be selected as a reference model for the U.S. Army, but there are some lessons learned we can use from the German implementation effort.

Independently managed SAP projects lead to independent and disparate solutions. Independent configurations with independent contractor teams will not lead to an integrated solution for the Army. A single Army focal point for ERP implementation management is required, and this single Army focal point needs a staff, a detailed build plan (i.e., methodology and architecture), and an enforcement mechanism.

We are recommending that a Strategies, Architectures, and Standards Group (SAS-G) be established, similar to the approach at the German armed Forces. The primary objectives of this group are:

- Manage and maintain the Army Logistics Enterprise Architecture
- Implementation and integration control across all projects,
- Standardization (Data, Processes, Organizational Structure),
- Define End-to-End process ownership, and
- Align implementation schedules and milestones.

The build plan behind this methodology is the Single Army Logistics Architecture. All standardization efforts must be integrated into the build-plan before the implementation projects can proceed to future milestones.

Managing the Single Enterprise

The Business Process Architecture contains the three core elements needed for any ERP implementation:

- Organizational Structure
- Business Processes
- Data Elements

The following figure shows the 3 core elements of the SAP software:

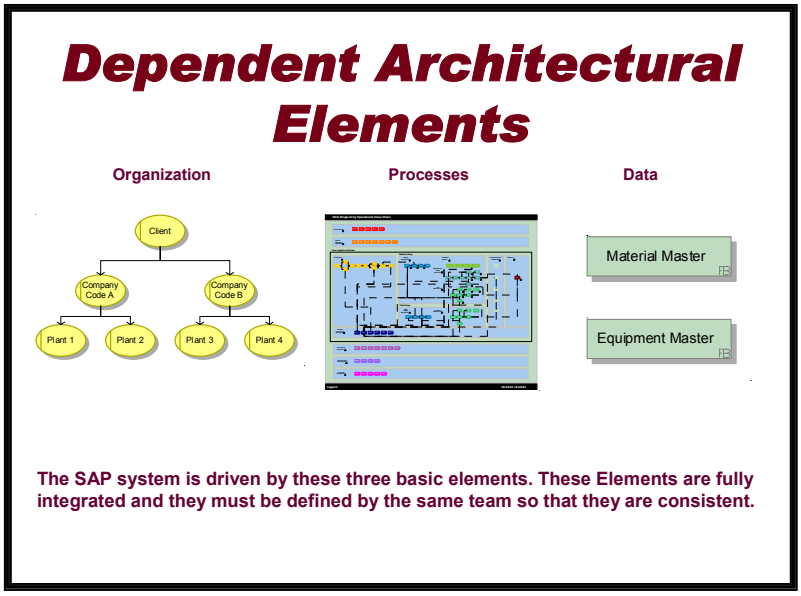

Figure 11.11: Dependent Architectural Elements

To implement an End-to-End Business Process Scenario (e.g., Total Life-Cycle System Management) multiple Enterprise Areas are involved. Every Enterprise contributes specific tasks (Processes), handles different data elements and is also partly organizational or financially involved. The following Figure shows that from every Enterprise Area only parts are required to enable a Business Process Scenario.

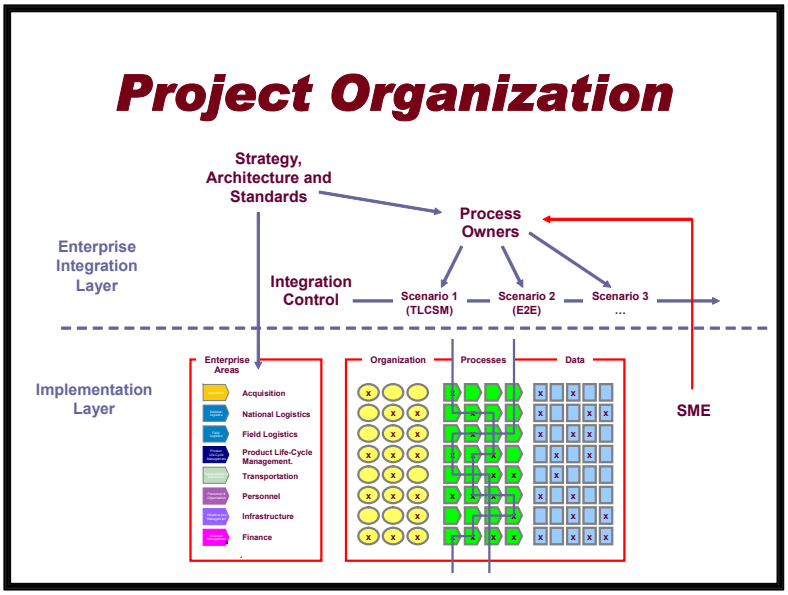

Figure 11.12: Project Organization for Enterprise Integration

Figure 12 also shows the difference between an Implementation layer and an Enterprise integration layer. The SAS-G is the owner of the overall Business Process Architecture, ensuring integration control over all required scenarios. For every Scenario, a scenario integration project must be instantiated by the SAS-G. The process owners together with a team of SMEs from the implementation teams define the changes to the Business Process Architecture, which also results in a documentation of the detailed requirements for the implementation teams.

The Roadmap to the Single Army Enterprise

The road map we recommend to be supported by the Strategies, Architectures, and Standards Group should roughly align with the following outline:

Preparation

Project Planning

- Identify the scope of business domain,
- Define the deliverables for the projects,
- Identify the Project Champions/Sponsors,
- Create project schedules,
- Establish Work Environment,
- Build project budget plan,

Team Planning

- Identify process owners,
- Identify project teams,
- Identify appropriate SMEs.

Management Sign-Off

- Review project plans,
- Release project budgets,
- Assign/engage project teams.

Strategy Definition

Requirements Definition Planning

- Identify interviews/assessments,
- Schedule interviews/assessments

Business Process Blueprint

Review Project Requirements

- Review scopes of existing projects,
- Review organizational requirements,
- Review business process requirements,
- Review data requirements,

- Review technical requirements.

Standardization

- Perform requirements gap analysis,
- Identify requirements for organizational standardization,
- Identify business processes,
- Identify requirements for data standardization,
- Define configuration differences,
- Prioritize configuration differences,
- Identify differences that are "show stoppers."

Management Sign-Off

- Prepare strategy/decision briefing,
- Brief Strategies, Architectures, and Standards Group,
- Brief Program Manager,
- Elevate higher if necessary.

After the final Sign-Off, the decision package to the implementation teams to start their ASAP or Global ASAP based project. The SAS-G tracks the implementation milestones to maintain integration control, since implementation control is a critical success factor for building the Single Army Logistics Enterprise.

It is important to identify the architectural impacts of changes before beginning an implementation project. The following picture shows how a new Business Process Scenario might affect an already implemented organizational structure, existing data and business processes.

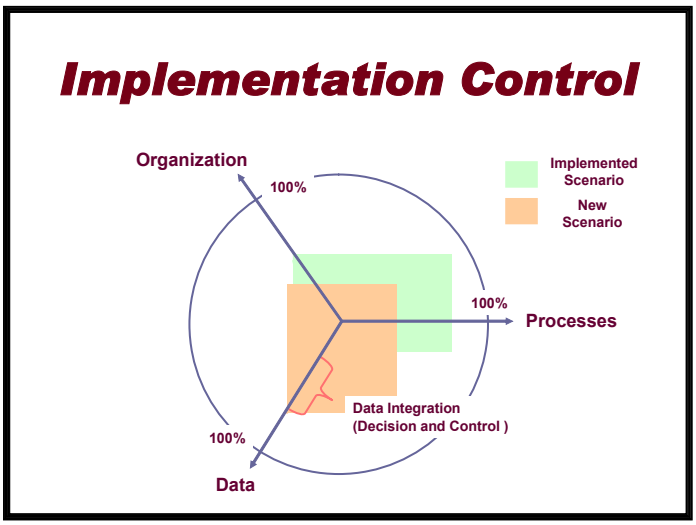

Figure 11.13: Implementation Control

Gartner View on Logistics ERP Governance

This section contains an independent assessment by the Gartner Group of the Army's governance model for enterprise integration that is important for integrating the single Army logistics enterprise. Described are the processes that an organization executes to achieve a best practice Logistics ERP Governance model. ERP governance should be viewed in the context of the Army enterprise and the Army's current realities.

Purpose

The purpose for this report is to document the Army's current state of logistics Enterprise Resource Planning (Logistics ERP) integration governance, compare that to best practices, and make recommendations to help ensure success of the Army's "One Army" logistics architecture.

The remaining sections of this report outline Governance Best Practices, the cost/ benefit and Best Practices in ERP deployment, the current state of the Army's Logistics ERP governance strategy, Gartner's gap analysis with the current governance strategy, and a set of actionable recommendations and alternatives for the Army to consider.

Recommendations in this report will focus on two areas: Tactical decisions and strategic initiatives. Tactical decisions will provide alternatives for decisions that need to be made immediately in order to move the Army in the right direction while building and institutionalizing the necessary Logistics ERP governance model. Strategic initiatives will show the end goal of where the Army needs to be to successfully realize a single enterprise architecture for logistics. Gartner uses our in-depth research tools in best practices to help guide our recommendations.

Gartner recognizes that logistics is one element of the Army Enterprise. All recommendations will need to be considered and implied in the context of the overall Army Enterprise.

Understanding the Problem

Issue

The Army's historical approach to logistics requirements and automated systems implementation has not positioned it well to meet its current enterprise level goals and objectives. This point is understood internally and externally to the Army and is clearly pointed out in the Army's "Army Logistics Enterprise Integration (EI) White Paper" dated 6 November 2002. The white paper states that:

"Historically, Army responsibilities regarding logistics requirements and automation have been diffused. This has resulted in multiple systems for logistics and financial business at the national, and installation/tactical echelons of the Army. Additionally, MACOMs have implemented non-standard automated management information systems unique solutions to fill needs for missing functionality or much-needed decision support tools. This has given us a "landscape" consisting of a multiplicity of automated systems which, in turn, has resulted in no single corporate view of our logistics chain and a very complex, expensive environment to sustain."

This issue juxtaposed with the Army's current logistics enterprise level vision, goals and objectives clearly reveal the need for an Army enterprise level logistics process and logistics automated information systems transformation. The following is the Army's stated logistics enterprise integration vision:

Vision: The enterprise integration vision consists of a fully integrated knowledge environment that builds, sustains, and generates warfighting capability through a fully integrated logistics enterprise based upon collaborative planning, knowledge management, and best business practices.

Several other factors complicate finding the solution to this logistics enterprise problem. The following list is a sample of those factors. The Army:

- Is a large set of organizations and has a "business" model that is very decentralized and somewhat disjointed.
- Currently has a large set of legacy systems that are stovepiped and not well integrated.
- Is heavily invested in several logistics systems modernization efforts that have not been formally integrated.
- Does not clearly measure the performance of its automated systems in a common way or at the enterprise level.
- Has a high-level logistics enterprise architecture that can be used to reach consensus on Army logistics process framework direction, but, is not detailed enough at this point to determine systems process compliance.
- Is addressing a funding hold on specific initiatives (i.e., LMP and G-CSS-A) until an enterprise architecture and governance model is put in place that supports the overall DoD direction.
- Does not currently have an organization structure to support a logistics enterprise-wide approach or collaborative planning.
- Due to the decentralization, has disparate processes, roles, and responsibilities which lead to redundancies and inability to operate as one organization.
- As a result of decentralization, does not have a 'One Army' culture within the Logistics ERP organizations. This culture is critical to drive changes and mindset to reflect on enterprise view versus separate stovepipes, and to break down current cultural challenges.
- Does not have a skills inventory or plan to support knowledge management at a logistics enterprise level.
- Has not yet aligned performance management goals and objectives to ensure successful achievement of mission and vision.

The DoD's intent is to help the Army achieve a "One Army" logistics enterprise architecture. The Army recognizes that it needs to accomplish this and has defined its goals and objectives. Also to address these issues, the Army is putting resources and a governance model in to place. But, there are significant political and cultural challenges that the Army will need to overcome.

In the near term, the Army needs to overcome several challenges in order to move the "One Army" initiative forward. Executive sponsorship at the top level needs to be established and clearly communicated for an effective governance model to work. The target logistics enterprise architecture is not fully developed, so there is a limited baseline around which to measure compliance of the individual system modernization initiatives. Additionally, any significant delays in complying with the DoD requests may put each Army logistics modernization program's fiscal year funding at risk. Moving to an enterprise architecture for logistics across the Army will require significant change—necessitating a change management strategy and plan to support and institutionalize long term sustainable change.

Army Logistics ERP Governance Goals and Objectives

The Army Logistics ERP Governance initiative will provide the Army with an enterprise level Logistics ERP Governance framework, principles, and process guidelines to better manage its resources. This Logistics ERP governance framework is founded on supporting the Army's Enterprise goals and objectives. The following is a list of Logistics ERP Governance goals as stated in the "Army Logistics Enterprise Integration (EI) White Paper":

- Implementation of an Integrated Logistics Enterprise which:
  - Provides a common operating picture
  - Provides Commanders at all levels, significantly improved capabilities to build combat power and manage readiness
  - Instill confidence through accuracy, reliability, and connectivity
  - Supports Army transformation deployment timelines
  - Is vertically and horizontally integrated
  - Is based on integrated business processes and rules
- Logistics Chain Management from the national level through the customer or consumer level
- Elimination of legacy processes and systems to the maximum extent possible
- Support joint interoperability requirements
- Flexibility to enable continual evolution of warfighting doctrine.

Best Practices View on Logistics ERP Governance

The next sections describe the process that an organization executes to achieve a best practice Logistics ERP Governance model. ERP governance should be viewed in the context of the Army enterprise and the Army's current realities.

Description

Logistics ERP Governance defines the assignment of decision rights and the accountability framework to create a decision-making process for determining the services, architecture, standards, and policies for the Army enterprise's Logistics ERP management. It ensures a management process of setting goals and establishing policies, practices, procedures, organizational structure, roles and responsibilities to provide reasonable assurance that its enterprise goals will be achieved.

Background

The Logistics ERP Governance model must address the realities of the Army's current business model, organizational structure, chain of command, funding practices, and decentralized decision-making processes. Designing and implementing Logistics ERP Governance by itself is not intended to change the enterprise's business model, operational processes or other "realities" of the enterprise's operations. Those decisions are made outside the scope of the Logistics ERP governance development process. Therefore, both the enterprise's Logistics ERP Governance framework and the implementation plan should be designed to recognize the business realities. The following are Army examples:

- Army Operations, including the supporting functions, involve complex processes that span multiple organizations
- Decision authority and accountability is distributed throughout the Army
- Current culture allows point-of-need projects/pilots to be implemented without an empowered overarching oversight structure
- Most Logistics ERP decisions are primarily focused on sub-organization goals and at most secondarily on the Army enterprise needs
- Various federal-wide legislation, statutes and policy require a certain level of centralized insight in to the Army systems implementation and reporting efforts.

To address the realities of an enterprise's operations, Gartner poses the following question, "Given the current operational model and the realities imposed by this model, how should the enterprise structure and implement Logistics ERP Governance?" To answer that question, Gartner uses the following process to develop the recommended Logistics ERP Governance Straw Model.

Logistics ERP Governance Straw Model Development Process

Gartner provides a straw governance model later in this section based on our understanding of the requirements to date and our best practices research. The Army should use this straw model as a baseline and refine it to reach consensus among the enterprise.

To establish effective Logistics ERP Governance, Gartner recommends the following approach:

- Achieve common understanding: Ensure that all stakeholders understand what Logistics ERP Governance is and what the key functions provided by an Logistics ERP Governance framework are.
- Articulate the enterprise goal(s) and associated value-chain(s): Ensure that all stakeholders clearly understand the enterprise goals and value-chains. Ensure that the Logistics ERP Governance framework is designed to support the goals, using the overarching value-chains as the framework.
- Identify and clearly define the primary challenges: Identify and clearly define the challenges the enterprise faces in meeting its enterprise Logistics ERP goal(s).

- Establish governance goals and objectives: For each problem, identify specific Logistics ERP governance goals and objectives that the enterprise will need to achieve in order to resolve the problem and support the enterprise goal(s).
- Develop a governance straw model: Conduct facilitated sessions with key enterprise stakeholders to construct an Logistics ERP Governance approach that best provides the enterprise with the appropriate Logistics ERP Governance functionality.
- Develop an implementation strategy and plan: Construct an Logistics ERP Governance implementation strategy and plan that is most appropriate for the enterprise.

Common Understanding

Key Logistics ERP Governance Functionality

In short, Logistics ERP Governance will provide the enterprise with a framework to make enterprise Logistics ERP investment and management decisions. Logistics ERP Governance will also establish the guidelines for determining how, and on what basis, tradeoffs should be made and how to prioritize current and future enterprise Logistics ERP related programs. The following are examples of how Logistics ERP Governance can help an enterprise:

- Use of an overarching value-chain, defining how enterprise Logistics ERP investment decisions are made and prioritize enterprise Logistics ERP initiatives
- Ensure clear alignment between the enterprise Logistics ERP initiatives and other initiatives (i.e., the Financial Management Enterprise Architecture (FMEA), Future Logistics Enterprise (FLE), and Army strategic goals/objectives)
- Ensure that the acquisition and management of enterprise Logistics ERP resources is tied into the current capital planning structure
- Involve decision-makers at all levels of the process to ensure accountability
- Approve organization structure, roles and responsibilities (as it pertains to the management of enterprise Logistics ERP investments)
- Resolve enterprise Logistics ERP questions and issues of enterprise importance.

Governance Functions

Consistent with industry best practices, Gartner recommends that an enterprise develop its Logistics ERP Governance straw model from a functional perspective. There are three primary tiers of Logistics ERP Governance functionality that an enterprise will need to implement. The three tiers are as follows:

- **The Executive/Strategic tier:** is the *ultimate decision making body* responsible for ensuring the alignment and integration of Logistics ERP with the enterprise goal(s) and value-chain(s). It is also responsible for ensuring

organizational commitment to Logistics ERP initiatives and adequate funding levels to sustain the initiatives, as appropriate.

- **The Execution/Program Oversight tier:** *independently verifies and validates the success of enterprise Logistics ERP programs*. It establishes specific program priorities, allocates resources, resolves disputes over the allocation of scarce resources, and monitors program compliance to business case. It also reports status to the Executive/Strategic tier and presents issues for final decision. Additionally, this tier assures the compliance of Logistics ERP initiatives to Federal legislation, statutes, and directives (e.g., GPEA, Section 508, OMB directives, etc.).
- **The Technical tier:** addresses the adoption and selection of integrative technology architecture, standards, and best practices to *ensure the interoperation* of internal enterprise systems as well external environments. The technical tier serves as subject matter expertise in support of the Executive/Strategic and Execution/Program Oversight tiers.

Current Army Logistics ERP Governance Approach

Gartner recognizes that there is a logistics enterprise architecture within the overall Army Enterprise and that the scope of the Deputy for Army Logistics Enterprise Integration (DALEI) is within the logistics domain for the Army enterprise. In order for the Army to be successful, the roles, responsibilities and relationships between the logistics enterprise initiatives and other Army enterprise efforts must be clearly defined and communicated. Strong communication and collaboration are essential.

To facilitate an understanding of the difference between the "Big Picture" Army architecture and the logistics domain across the enterprise architecture, Gartner offers its definition of ERP. In general, ERP involves software packages that automate and support the processes of the administrative, production, inventory, and product development aspects of an enterprise. ERP is considered the back-office application set and is defined as traditional ERP, human resources management systems (HRMS) and financial management systems (FMS).

The scope of the Army's logistics domain falls within the Traditional ERP definition. Traditional ERP is an integrated application software suite that helps automate manufacturing, distribution and financial business functions as they relate to manufacturing. Traditional ERP evolved from manufacturing resource planning (MRP II) with the introduction of RDBMS, 4GL development tools, BI and second- and third-generation architectures (client/server and Web-based, three-tier technologies). Traditional ERP consists of: plant/manufacturing operations, corporate functions and direct purchasing/procurement "blue collar".

Plant/Manufacturing Operations includes, but is not limited to, master production scheduling, material requirements planning (including regenerative MRP), costing, inventory control, bills of material/routing (including engineering change control), capacity requirements planning (including input/output control, finite scheduling and infinite scheduling), and quality tracking/control.

Corporate Functions include, but are not limited to, fulfillment, order management, asset management, service management, project management, corporate compliance and quality assurance and quality control.

Within the Logistics ERP domain, you can see that the Traditional ERP definition crosses many disparate, disjointed organizations (e.g., acquisition, sustainment, and field). Implementation and deployment success hinges on the proper governance model as shown in the cost/ benefit and best practices section at the beginning of this report.

Current Governance Structure

The Army's current governance approach, as outlined in the "Army Logistics Enterprise Integration (EI) White Paper", follows a three tiered approach to governance. Based on documentation review and limited interviews, it appears that the DALEI will be supported by and be a part of the three standing bodies that comprise the as-is governance model (once implemented):

- **Executive Steering Committee (ESC) –** 3 Star level (DCG AMC, HQDA G4 and G6, ASA FM&C, DUSA, and CG CASCOM) – primary focus is to provide strategic direction, guidance, and resources to the DALEI effort. Meets quarterly as a minimum or at the direction of CG AMC.
- **Enterprise Integration Advisory Board (EIAB) –** 2 Star/SES level – (MACOM Wide participation). Provides change management, integration, and synchronization advice to the DALEI. Meets monthly or at the direction of the DALEI.
- **Integration Control Working Group (ICWG) –** Action officer/SME level participation from HQDA G-4, DALEI, LAISO, and CASCOM staffs augmented by key stakeholder organizations and MACOMs. This group is focused on enterprise integration and dispute resolution issues as their primary responsibility.

Proposed Straw Governance Model

The three Army Logistics ERP Governance bodies do not apply Gartner's three-tier model as effectively as they could. Gartner believes there are issues with all three levels, as such (see Figure 7 and Note [26]):

- The Army Executive Steering Council (ESC) and The Army Enterprise Integration Advisory Board (EIAB) should execute the functions of the Executive/ Strategic tier. Given their logistics community membership, they need to make sure that their decisions and directions are in line with the Army Enterprise as a whole.
- The Execution/ Program oversight tier currently resides within DALEI/ PEO-EIS. This tier has responsibility for chartering the technical tier for compliance assessments and reporting progress to the strategic tier.
- The Integration Control Working Group (ICWG) should not execute at the Technical tier, rather Gartner recommends that the Systems, Architectures, and Standards Group (SAS-G) execute the functions of the Technical tier. The ICWG has not been effective in the Technical tier with similar enterprises. To ensure success with the SAS-G, it needs to be placed high enough within the Logistics ERP organization to drive standards and compliance; therefore, it should report to Tier 1 – Army ESC. In addition, the

[26] **Note 2:** This is a model that the Army will need to refine based on the realities within the enterprise.

SAS-G needs to be connected with the Army Enterprise Architecture team to ensure future Logistics ERP compliance.

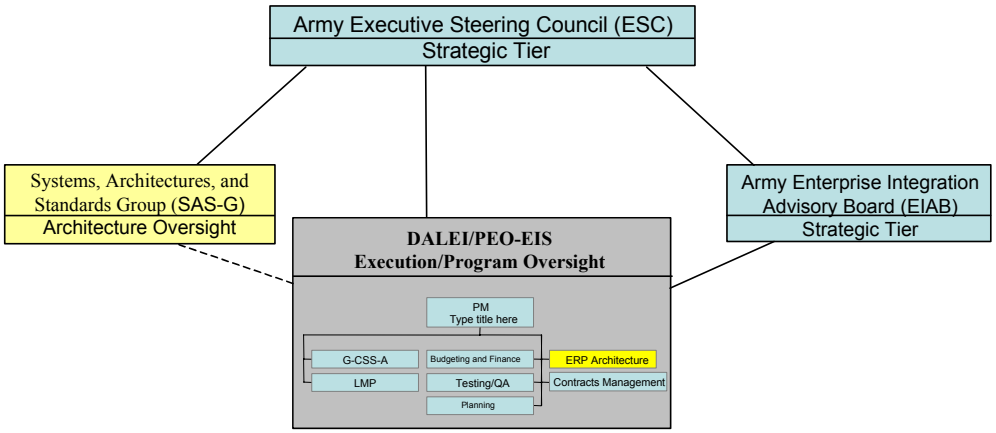

Figure 11.14: Army Logistics ERP Straw Governance Model

Staffing of these Logistics ERP Governance bodies is important so that this is recognized as an Enterprise Initiative. They should be staffed with real decision-makers at the appropriate level to make the hard decisions that will advance the development from a logistics enterprise perspective. The principals should attend the periodic meetings, that is, attendance should not be delegated to the deputy level.

These Governance bodies will need to be chartered according to their assigned Logistics ERP Governance functionality.

Governance Gap Analysis

Based on documentation review and limited interviews, Gartner compared the Army's current Logistics ERP Governance Model with best practices and found that the following areas require additional work to achieve a best practices approach and ensure success for the Army from an enterprise perspective:

Governance Model: Gartner recommends that the Army re-configure their existing governance model to fit the model shown in Figure 7. The Army Executive Steering Council (ESC) and The Army Enterprise Integration Advisory Board (EIAB) should execute the functions of the Executive/ Strategic tier, while making sure that their decisions and directions are in line with the Army Enterprise as a whole. The Execution/ Program oversight tier currently resides within DALEI/ PEO-EIS. The Systems, Architectures, and Standards Group (SAS-G) execute the functions of the Technical tier.

Communications plan: To present the overall Logistics ERP Governance Model across the Army and communicate the enterprise goals and objectives of a "One Army" logistics architecture. This plan must demonstrate that this initiative is directed at an Enterprise Executive level. The communications plan should:

- Determine all the key stakeholders
- Determine the message to communicate to the stakeholders:

  - Governance model
  - Compliance process
  - Establishment of working groups to facilitate knowledge transfer.
- Determine what information is required back from the stakeholders
- Determine how often communications will occur and via what media
- Set periodic reviews.

Clearly defined and measurable Army enterprise goals and objectives: To provide a foundation towards which multiple initiatives can work to ensure successful implementation of the "One Army" logistics architecture. Gartner understands that some of this work has started, but needs to be included in the communications plan.

Clearly defined and measurable Logistics ERP Governance goals and objectives: To ensure that the Logistics ERP Governance process is understood across the enterprise and provides effective leadership. Establish Logistics ERP Governance buy-in and acceptance.

- Communicate business importance.
- Craft business message and take it to the road.
- Secure acceptance from Army's senior most executives (at each level).
- Secure an executive sponsor and publish a "Management Memorandum".

Clearly defined charters and principles: To ensure that Army governance organizations understand their missions and objectives towards integrating the Army's Logistics ERP architecture. Develop and ratify a "Logistics ERP Constitution" that officially establishes formal Logistics ERP Governance.

- Defines Army's Logistics ERP Governance framework (tiers, councils, functions, roles/responsibilities).
- Logistics ERP Governance buy-in and acceptance is mandatory for ratification.
- Must be ratified by Army's Executive leadership. Gartner understands that there is a logistics enterprise architecture within the overall Army Enterprise and that the scope of the DALEI is within the enterprise logistics domain for the enterprise. In other words, the Army Enterprise is much larger than just the logistics architectures. However, Army leadership should determine the DALEI and AEIO roles and responsibilities as they relate to the Army Enterprise Architecture. There is a basic inconsistency between their two charters that needs to be resolved. Gartner recommends that the DALEI take the lead role on Army Logistics ERP initiatives and that once AEIO develops an overall Army Enterprise Architecture, that DALEI assess its fit and makes any changes required to be compliant.

Governance body memberships and voting rights: To enforce compliance and allow a voice across the enterprise to establish and implement enterprise requirements. Ratify charters for each council/committee (within each tier) of the Logistics ERP Governance framework established within the "Logistics ERP Constitution".

- Officially inaugurates each respective council.

- Defines each council's mission objective, role and responsibility, functions, relationships to other councils, membership, voting rights and privileges, and guiding principles.

Documented governance processes: To clearly understand how Logistics ERP governance decisions will be made (e.g., dispute resolution). These rules and processes are used to govern behavior. As the Army adopts a strategic-services model, disjointed agencies and departments must break down the old rules of engagement and develop new techniques to cooperate and leverage resources.

Uniform performance management framework: Governance is about identifying, understanding, and communicating the implications and trade-offs that are involved in architectural choices. To shorten the Army's decision making process, as well as simplifying the governance process itself, the Army should consider implementing a uniform performance management framework. Using TCO or other such frameworks provide the Army not only with a consistent language for communications between disparate constituents (e.g., acquisition, sustainment, field), but equally with the opportunity to benchmark and assess the appropriateness of the cost of current and future ERP or Army enterprise architectures.

Clear final decision authority: Currently the final decision authority is neither defined nor clear. Two enterprise organizations (DALEI and AEIO) have charters giving conflicting authority. Gartner recommends that DALEI execute in the enterprise logistics domain and that this is communicated to ensure the final decision authority is understood.

Mature architecture: The Army enterprise architecture is not defined at a level that could provide guidance for other enterprise initiatives in their development. Gartner recommends that once the enterprise architecture is developed then the logistics enterprise initiatives will have a baseline around which compliance can be achieved with other Army initiatives.

Architecture compliance process: To measure and track initiatives and ensure that they support the success of the "One Army" logistics architecture.

Organization Structure: Gartner agrees with the goal of a "One Army" logistics architecture. However, best practices for Logistics ERP Governance includes sponsorship at the Enterprise level. Currently the function Execution/ Program Oversight function resides in AMC, which is one of the Army constituencies within the logistics community (e.g., Army Materiel Command, Army G-4, Training and Doctrine Command, Defense Logistics Agency, Office of the Chief of Army Reserves, Army National Guard, and Office of the Surgeon General). This structure promotes concern that the Execution/ Program Oversight function has sub-enterprise bias and alliances with AMC and is potentially not an honest broker for the logistics community. Gartner recognizes that there are credible reasons for why this function is slated to be located within AMC (e.g., stable support infrastructure). Two options present themselves as alternatives:

- Pull the Execution/ Program Oversight function to an enterprise level to demonstrate enterprise governance.
- Clearly demonstrate the steps that AMC is going to take to mitigate the perceptions discussed above. This will require a very focused effort.

Skills: May need to address skill gaps, or lack of current skill/competency information.

Recommended Roadmap for Implementation

"To assure a convergent path, I am designating the USAMC as the single agency in charge of designing and fielding a logistics system that ensures seamless end-to-end business processes and automated systems that best support Army needs. As we move toward web-based systems and processes, it is even more important that we have a single developer—not just an integrator—to ensure seamlessness not only within the Army but also through to the Department of Defense." - John M. Keane Vice Chief of Staff

Tactical Decisions

There are tactical decisions that need to be made from financial, functional, people, and process perspectives.

The funding holds that are in place for specific initiatives (i.e., LMP and G-CSS-A) may cause funds to be reallocated to other programs if not used in the short term. There are four potential scenarios that describe a go forward plan for the current initiatives. Pros and cons of each are listed in Table 1.

- Each initiative implements the specific "One Army" target architecture and design guidelines
- Each initiative continues on its current course with individual architecture directions
- Each initiative stops everything until the "One Army" target architecture and governance model are completed
- Converge now to move staff from each initiative into an enterprise logistics role to advance the completion of the logistics enterprise architecture and governance model.

Gartner sees the following pros and cons of each decision listed above:

Table 1. Possible Tactical Scenarios

Decision	Pros	Cons
Each initiative implements the specific "One Army" target architecture and design guidelines	Applies best practices approach to ensure "One Army" goals and objectives Aligns with FLE and FMEA goals and objectives	Architecture is not at a detailed level to provide this information (requires a compliance strategy that is mature and complete)
Each initiative continues on its current course with individual architecture directions	Less risk of funding loss	Does not move towards a "One Army" logistics architecture Does not support FLE or FMEA
Each initiative stops everything until the "One Army" target architecture and governance model are completed	Applies best practices approach to ensure "One Army" goals and objectives Aligns with FLE and FMEA goals and objectives	Risk of funding loss if delayed too long Intense political and cultural resistance
Converge now to move staff	Supports detailed definition of the	Without proper initial planning &

from each initiative into an enterprise logistics role to advance the completion of the logistics enterprise architecture and governance model	architecture and governance to ensure compliance, encourages buy-in from the Logistics ERP organization Applies best practices approach to ensure "One Army" goals and objectives Aligns with FLE and FMEA goals and objectives	definition of new structure, roles, and responsibilities may result in inappropriate structure to support business, or unqualified personnel

An executive decision is required to select one of the four possible scenarios listed above. Once a direction is selected, then:

- A risk management plan will be required to mitigate the risks beginning with those identified in the "cons" section.
- A transition plan should be developed to map out how each initiative will achieve the "One Army" target architecture.

Strategic Initiatives

Enterprise Goals

The Army, a very large complex organization, has several major systems implementation efforts underway that are focused on sub-organization goals. The "sponsors" of these initiatives often make funding and architecture decisions primarily based on sub-organization or location specific goals and have a secondary interest in the Army enterprise level impact. A crucial strategy in developing the Logistics ERP Governance straw model is that: "Enterprise goals are the central focus and supporting them is top priority." Logistics ERP Governance decision-makers need to make decisions that support the enterprise goals and only allow waivers under extraordinary circumstances.

Enterprise goals are a crucial part of Logistics ERP Governance development. The Army needs to clearly articulate those goals and reference them throughout this process. The following could be potential Army Enterprise Goals:

Table 2. Potential Army Enterprise Goals

	Goal/Objective Descriptions	Metrics	Sponsor	Key Dates
1.	Continuously improve current and future readiness		TBD	
2.	Provide Army leadership with accurate and timely information for decision making		TBD	
3.	Establish common business practices		TBD	
4.	Reduce and realign manpower		TBD	
5.	Reduce overall operating cost		TBD	
6.	Reduce Major Product Cycle Time		TBD	
7.	Shorten the Product Improvement Cycle		TBD	
8.	Increase the Quality of Logistics Support		TBD	
9.	"Improve Warfighter Satisfaction" – Provide Better Products and Services		TBD	
10.	"Lower the Total Ownership Cost of Equipment and Services" – Provide Products and Services Cheaper, maximize the investment in technology and people		TBD	
11.	"Reduce Cost and Cycle Time for Delivering Equipment and Services" – Provide Products and Services Faster		TBD (RDA)	

Challenges

Challenges are some of the obstacles that could prevent the Army from realizing its enterprise goals. Challenges need to be clearly identified, defined and addressed with mitigation strategies. The Logistics ERP Governance structure is a tool that should be used to help mitigate those challenges. The Army should not expect Logistics ERP Governance to solve all of its ERP problems. Rather, the Army should focus on the top (most pressing) issues to ensure that they are resolved through the Logistics ERP Governance efforts.

Gartner proposes the following as the Army's most pressing ERP related challenges that need to be mitigated through Logistics ERP Governance:

Ability to develop and agree on a clear value-chain(s) for benchmarking improvements to current and future readiness: Within this structure, executive leadership can align current and future ERP initiatives, set priorities, develop the business case and assign responsibilities. The underlying business processes provide the means for measuring the effectiveness and efficiencies of the configured solutions.

Achieving efficiencies and improved effectiveness by implementing common business processes across the Army's value-chain(s): Each Army ERP initiative has a sponsor. The Army has only recently identified an Executive ERP sponsor that represents Army-wide interests. The absence of an Executive level sponsorship does not establish accountability or sustained commitments from the pilots to work together in support of Army enterprise level goals. "Common business processes" is one of the Army's enterprise level goals. Logistics ERP Governance can mitigate this problem by integrating sponsorship, accountability and oversight of the major ERP initiatives at the Army enterprise level.

Ensuring accurate and timely information: It is not clear how the individual ERP pilots will share and support the information requirements across the enterprise as well as at the Army executive level. A coordinated requirements process and an ERP Technical Oversight function can help to mitigate this issue.

Reducing overall operating costs: The Army currently exercises decentralized ERP decision making and cost control practices. Logistics ERP Governance can support business/Logistics ERP alignment by ensuring that all major ERP investments and management decisions are made with direct linkage to the Army's mission and enterprise goals. Business/Logistics ERP alignment prevents the misallocation and commitment of scarce resources (people and budgetary).

Reduce costs and cycle times for product delivery and shorten the product improvement cycle: Army weapon systems are highly integrated and complex assets. Reducing costs and improving cycle times involves the coordination of multiple disciplines across multiple organizations. Logistics ERP Governance can mitigate this problem by coordinating Army-wide initiatives with the ERP initiatives.

Project Performance and Oversight: Army ERP reviews may discover missed project deadlines, unmet requirements (reduced scope), and miscommunications between the Army leadership, ERP project teams, and the user community. Each of these is a form of project failure. Logistics ERP Governance can help to mitigate this problem by

establishing an executive level ERP project/program oversight board/council to track project performance and ensure business requirements are being met according to a Army ERP business case (e.g., realize stated benefits, on time and within budget).

Relationship Management: Relationships with the business and across the Logistics ERP organization will change, as the way of operating changes. Logistics ERP Governance through proper organization structure and change management and communication strategy and planning will prepare the organization for the change, and ensure strong relationships during and after the implementation.

Model Development Principles

The following list represents potential guiding principles that the Army should consider during the development of the Logistics ERP Governance Framework:

- Use an Army value-chain approach to frame the investment decisions, priorities, and business process alignment. Incorporate these frameworks into the Army's logistics enterprise architecture.
- As appropriate, make maximum use of proven Army processes and initiatives.
- There must be one ultimate decision authority for all Army Logistics ERP funding approvals.
- The Army Logistics ERP initiatives must be converged under one oversight structure, with clearly defined roles, responsibilities, and competencies.
- An approved Army Logistics ERP business case must be used as a baseline to measure Army Logistics ERP performance.
- The Army Logistics ERP initiatives must be converged into following one consistent set of architecture guidelines and process.
- Logistics ERP Governance straw model development must focus on Governance functionality, and how that functionality can be implemented within the current Army environment before considering the who
- The model prescribes the structure best suited for providing Logistics ERP Governance functionality within the Army's complex business environment.
- Ensure that the challenges have been addressed by mapping them to the Logistics ERP Governance Straw model.
- Keep it simple.

Straw Model Structure

Gartner recommends that the Army start with the straw model defined in Figure 7. This best supports the three-body Logistics ERP Governance structure to execute the functions associated with each of the three tiers previously identified.

Actions:

1. Take the straw model defined in this document
2. Make any refinements required based on the best practices process outlined
3. Come to consensus at the Army enterprise level
4. Implement the governance structure.

Once the Army Logistics ERP Governance framework is finalized, the Army could pursue the following implementation strategy (some of these steps have already been started). This implementation strategy and plan should focus on the technology, people, and process components of the implementation.

Develop a transition strategy and plan taking into account technology, people and process. It should include:

- A change management strategy and plan (the guiding principles of the change effort, desired cultural change and approach to change, executive sponsors, risk identification and risk mitigation, timeline, and key resources needed to support the change.
- A communication strategy and plan (audiences, communication mediums, identified roles in communicating, key overarching messages aligned to the Army enterprise and enterprise Logistics ERP strategy, mission, and vision).

The specific activities needed to support full implementation. This initiative should be run as a program, using a Project Management methodology and approach required for large-scale project initiatives. Determine the key steps to ensure successful buy-in and rollout. Base this on a 360 perspective—the business, enterprise Logistics ERP leadership, enterprise Logistics ERP staff. What are the specific tasks that need to be accomplished to ensure long-term change from these various perspectives?

Gain enterprise Logistics ERP governance buy-in and sponsorship across the Army organizations.

- Determine the roles and responsibilities of the DALEI and AEIO to support the Army enterprise Logistics ERP initiatives going forward.
- Communicate the importance and role of Army enterprise Logistics ERP governance to the Army's senior most executive team. This is a key communication activity that is part of the Communication strategy and plan, and needs to be followed up with communication to all audiences.
- Establish executive acceptance of the need for enterprise Logistics ERP governance at the Army.
- Identify the executive sponsor (General Kern is recommended) for implementing the new Army enterprise Logistics ERP governance.

Develop and ratify an Army enterprise Logistics ERP constitution that formally establishes the Army's enterprise Logistics ERP governance.

- The Army enterprise Logistics ERP constitution will be the official documentation addressing the governance of ERP at the Army. It establishes the Army's formal enterprise Logistics ERP governance model, and defines the roles and responsibilities of each stakeholder.
- Finalize and gain consensus on the framework from which the Army will make critical enterprise ERP decisions and manage the Army's mission-critical information.
- Ensure senior executive support and commitment to establishing an Army enterprise Logistics ERP governance framework.

Create an enterprise-wide Army Logistics ERP Performance Measurement Program.

- Establish the framework for the Army Logistics ERP domain (e.g., value-chain).
- Identify the highest priority ERP related areas to address first.
- Develop "threshold guidelines" to identify the ERP related issues that are not subject to the Army Logistics ERP Governance process.

Finalize and ratify the charters for each of the three councils previously discussed. Officially establish and execute the responsibilities of the three tiers of Army Logistics ERP Governance. Execute the Army Logistics ERP Governance Process based on the above defined strategies and plans.

Army Logistics ERP Governance Initiative

Table 3. (Sample) Army Logistics ERP Governance Initiative Description

Analysis	Description Summary
Initiative	Implement Logistics ERP Governance
Benefit	The Army will be employing an industry best-practice approach for managing and delivering ERP projects across the enterprise that will: ■ Provide for more efficient use of Army resources and budget ■ Help manage ERP projects within the Army ■ Support interoperability efforts with other internal and external systems ■ Establish a formal approach for prioritizing and pursuing ERP projects ■ Position information as a Army-wide resource that is aligned with the business ■ Include key stakeholders from across the Army ■ Provide for the rationalization of technical infrastructure ■ Provide management and oversight for ERP Projects.
Risks	The primary risk for not instituting Logistics ERP Governance is continuing the status quo with no more than an incremental improvement in the delivery of ERP based services. End users and Army staff will be frustrated and the Army will not be able to maximize its investment in ERP. Additionally, the Army runs the risk of not being able to soundly prioritize ERP related projects and trying to be all things to all people within the Army. Various stakeholders, including Executives must buy in to this Logistics ERP Governance process. Without the proper buy-in, the Army will remain at the status quo.
Cost Estimate Detail	The cost for this effort is primarily staff time. The Army should anticipate providing dedicated resources for the governance roles.
Priority	High-priority initiative
Start Date	Immediate
Performance Measures	■ Executive sponsor identified ■ Oversight Councils chartered ■ Meetings held ■ Education/training completed ■ Processes documented

Appendix

A Appendix A - References

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Appendix

B Appendix B - C4ISR Framework

Overview

The Army Business Process Architecture conforms to the C4ISR Architectural Framework (U.S. DoD, 1997) standards for expressing operational, systems and technical views of architecture components. Architectures provide a mechanism for understanding and managing complexity. Within the United States Department of Defense exists a standard framework to express architectures. This framework is called the C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) architecture framework. The purpose of the C4ISR architecture framework is to express operational architectures that enable the quick synthesis of "go-to-war" requirements with sound investments leading to the rapid employment of improved operational capabilities. The ability to compare, analyze, and integrate architectures developed by the geographical and functional, unified Commands, Military Services, and Defense Agencies from a cross-organizational perspective is critical to achieving these objectives.

The C4ISR Architecture Framework is intended to ensure that the architecture descriptions developed by the Commands, Services, and Agencies are expressed in a sufficiently common manner to enable communications between and among organizations. This common framework is essential to creating architectural planning tools that may be compared and integrated across Joint and combined organizational boundaries. This does not mean that all DoD architectures are identical. **The C4ISR framework does not specify particular tools or modeling methodologies, but provides the flexibility to adapt the architecture to particular user needs.** Hence, even though the C4ISR framework was not developed to support ERP implementations, it is adaptable.

The Framework provides the rules, guidance, and product descriptions for developing and presenting architecture descriptions that ensure a common denominator for understanding, comparing, and integrating architectures. The application of the framework enables architectures to contribute most effectively to building interoperable and cost-effective military systems.

Definition of the Operational Architecture

The operational architecture is a description of the tasks and activities, operational elements, and information flows required to accomplish or support a military operation. It contains descriptions (often graphical) of the operational elements assigned tasks and activities, and information flows required to support the warfighter. It defines the types of information exchanged, the frequency of exchange, which tasks and activities are supported by the information exchanges, and the nature of information exchanges in detail sufficient to ascertain specific interoperability requirements.

Just from the definition, it is evident that the C4ISR Framework is not a perfect fit for ERP. Information exchange requirements are critical for analyzing systems that are comprised of families of interfaced legacy systems. Since ERP is integrated, as opposed to interoperable, information exchanges are minimized, making information exchange views less meaningful. Also, as previously mentioned, data models are critical for documenting software development requirements, but there is no software development with ERP, rendering this view of minimal importance. Other differences exist, but as previously noted, the C4ISR framework does not specify particular tools or modeling methodologies, but provides the flexibility to adapt the architecture to particular user needs.

Table 1. C4ISR Operational Views

Operational	OV-1	High-level Operational Concept Graphic	Essential	High-level graphical description of operational concept (high-level organizations, missions, geographic configurations, connectivity, etc.)
Operational	OV-2	Operational Node Connectivity Description	Essential	Operational nodes, activities performed at each node, connectivities & information flow between nodes
Operational	OV-3	Operational Information Exchange Matrix	Essential	Information exchanged between nodes and the relevant attributes of that exchange such as media, quality, quantity, and the level of interoperability required
Operational	OV-4	Command Relationships Chart	Supporting	Command, control, coordination relationships among organizations

Table 1. (continued)

Operational	OV-5	Activity Model	Supporting	Activities, relationships among activities, I/Os, constraints (e.g. policy, guidance), and mechanisms that perform those activities. In addition to showing mechanisms, overlays can show other pertinent information
Operational	OV-6a	Operational Rules Model	Supporting	One of the three products used to describe operational activity sequence and timing that identifies the business rules that constrain the operation
Operational	OV-6b	Operational State Transition Description	Supporting	One of the three products used to describe operational activity sequence and timing that identifies responses of a business process to events
Operational	OV-6c	Operational Event/Trace Description	Supporting	One of the three products used to describe operational activity sequence and timing that traces the actions in a scenario or critical sequence of events
Operational	OV-7	Logical Data Model	Supporting	Documentation of the data requirements and structural business process rules of the Operational View

Definition of the Systems Architecture

The systems architecture is a description, including graphics, of systems and interconnections providing for, or supporting, warfighting functions. For a domain, the systems architecture shows how systems link and interoperate. The systems architecture may also describe the internal construction and operations of particular systems within the architecture. For individual systems, the systems architecture includes the physical connection, location, and identification of key nodes (including materiel item nodes), circuits, networks, warfighting platforms, etc., and specifies system and component performance parameters (e.g., mean time between failure, maintainability, availability). The systems architecture aligns physical resources and their performance attributes to the operational architecture and its requirements per standards defined in the technical architecture.

This view is important for ERP, but the orientation is slightly different when aligning resources with an integrated domain as opposed to an interoperable domain. In the case of ERP, system links are minimized, and in fact are non-existent within the context of a single implementation management guide (IMG). Interfaces with legacy or stovepipe environments must be documented, but in reality, this documentation is independent of ERP. This does not mean that a systems architecture is not useful in an integrated as opposed to interoperable environment, but only that it is used differently. It is used primarily to document those systems that are external to ERP and how they related to ERP.

Table 2. C4ISR System Views

Systems	SV-1	Systems Interface Description	Essential	Identification of systems and system components and their interfaces, within and between nodes
Systems	SV-2	Systems Communications Description	Supporting	Physical nodes and their related communications laydowns
Systems	SV-3	Systems² Matrix	Supporting	Relationships among systems in a given architecture; can be designed to show relationships of interest, e.g., system-type interfaces, planned vs. existing interfaces, etc.
Systems	SV-4	Systems Functionality Description	Supporting	Functions performed by systems and the information flow among system functions
Systems	SV-5	System Information Exchange Description	Supporting	Mapping of system functions back to operational activities
Systems	SV-6	System Information Exchange Matrix	Supporting	Detailing of information exchanges among system elements, applications an H/W allocated to systems elements
Systems	SV-7	Systems Performance Parameters Matrix	Supporting	Performance characteristics of each system(s) hardware and software elements, for the appropriate time frame(s)
Systems	SV-8	System Evolution Description	Supporting	Planned incremental steps toward migrating a suite of systems to a more efficient suite, or toward evolving a current system to a future implementation
Systems	SV-9	System Technology Forecast	Supporting	Emerging technologies and software/hardware products that are expected to be available in a given set of timeframes, and that will affect future developments of the architecture
Systems	SV-10a	Systems Rules Models	Supporting	One of three products used to describe systems activity sequence and timing – Constraints that are imposed on systems functionality due to some aspect of systems design or implementation
Systems	SV-10b	Systems State Transitions Description	Supporting	One of three products used to describe systems activity sequence and timing – Responses of a system to events
Systems	SV-10c	Systems Event/Trace Description	Supporting	One of three products used to describe systems activity sequence an timing -- System-specific refinements of critical sequences of events described in the operational view
Systems	SV-11	Physical Data Model	Supporting	Physical implementation of the information of the Logical Data Model, e.g., message formats, file structures, physical schema

Definition of the Technical Architecture

The technical architecture provides the minimal set of rules governing the arrangement, interaction, and interdependence of system parts or elements, whose purpose is to ensure that a system satisfies a specified set of requirements. The technical architecture provides the technical systems-implementation guidelines upon which engineering specifications are based, common building blocks are established, and product lines are developed. The technical architecture includes a collection of the technical standards, conventions, rules and criteria organized into profile(s) that govern system services, interfaces, and relationships for particular systems architecture views and that relate to particular operational views.

This view, again, is less important for ERP, since ERP follows mainstream commercial standards. In fact, the basis level technology for SAP runs on standard hardware from many vendors. These vendors align with commercial infrastructure standards, and a product like SAP guarantees technical compatibility with the solutions of industry-leading infrastructure providers. So, it is not that the technical views are not important, but they are less important, since commercial packaged software attempts (on purpose) to make these issues as transparent to the user as possible.

Table 3. C4ISR Technical Views

Technical	TV-1	Technical Architecture Profile	Essential	Extraction of standards that apply to the given architecture
Technical	TV-2	Standards Technology Forecast	Supporting	Description of emerging standards that are expected to apply to the given architecture, within an appropriate set o timeframes

C4ISR Compliancy

The C4ISR Architecture Framework does not define the supporting tools nor modeling standards that are used to build a C4ISR-compliant architecture. As it should be with a flexible architectural framework, multiple tools and documentation standards could be used to express the required C4ISR views. The Army, because of its investment in SAP, is using the SAP documentation standard and should use the ARIS Collaborative Suite to support the documentation.

The ARIS methodology and associated toolset is fully compliant with the C4ISR framework. ARIS supports all essential and supporting views and combines them in one object-linked repository.

The C4ISR framework only defines “what” should be described, not “how” it should be described; i.e., C4ISR is a tool-independent framework. Table 4 shows examples of methods in ARIS that could be used to address the requirements of individual views, but this is not an exhaustive list of all methods that could address the views. Each C4ISR view could, in fact, be constructed from one or more of the hundreds of methods supported by the ARIS Toolset, or other tools.

Table 4. ARIS and C4ISR Compliancy

C4ISR View	Supporting ARIS Method
OV-1	**Value Added Chain Diagram (VACD)**: The value added chain diagram allows you to describe the high level functions that support the mission or the vision of the organization. Organizational responsibilities, information objects, location etc. can be associated with this model.
OV-2	**Value Added Chain Diagram (VACD**): The value added chain diagram allows you to define operational nodes, the performed activities at each node as well as the information flow and the connectivity between nodes
OV-3	**Value Added Chain Diagram (VACD**): The value added chain diagram allows you to define the information exchanged between nodes. In ARIS all relations are able to carry detailed attributes to describe details like media, quality, quantity, and the level of interoperability required. If these attributes are a substantial part of an architecture and reuse is critical attributes could also be described as objects.
OV-4	**Value Added Chain Diagram (VACD)**: The value added chain diagram allows you to describe the high level functions that support the mission or the vision of the organization. Organizational responsibilities, information objects, location etc. can be associated with this model. Or **Organization Chart**: The organizational chart is a form of representing organizational structures. A chart of this kind reflects the organizational units (as task performers) and their interrelationships, depending on the selected structuring criteria such as command, control, and co-ordination.
OV-5	**Function Tree**: The function tree describes a functional decomposition of the overall operational architecture.
OV-6	**EPC (Event Process Chain)**: The event process chain is used to describe the process in either a detailed or an overview format. A combination of events & functions (along with the data in the form of inputs, outputs, systems, organizational units) are used to describe sequence and timing of operational activities. Logical business operators are provided in this model type to help identify & represent the business rules that constraint the operation.

Table 5. (continued)

C4ISR View	Supporting ARIS Method
SV-1	**Application System Diagram**: The application system diagram allows you to describe the identified systems as well as system components and their interfaces Or **Value Added Chain Diagram (VACD)**: The value added chain diagram also allows you to describe identified systems and their integration across notes. Furthermore a value chain is able to describe a SV-1 and a SV-5 in different or in one view.
SV-5	**Value Added Chain Diagram (VACD)**: The value added chain diagram also allows you to describe identified systems and the mapping of system functions back to operational activities.

Since ARIS can display information in the format of SAP, then by extension, SAP documentation can be displayed in accordance with the C4ISR Architectural Framework. However, this statement is qualified by the previous discussion about the relevance of certain views for commercial standard software; e.g., the SAP data model could be published as an OV-7. The core data model is suppressed in SAP, and is not important from an implementation point of view.

Appendix

C

Appendix C – The ARIS Framework

Background

Due to an increasing desire for standardization and a dramatic drop in hardware prices, information system development and implementation approaches have changed considerably. Historically, industry focused on optimizing system design and system integration. In recent years, however, the focus has shifted towards creating solutions for the special demands of individual sectors. Decentralized information systems are increasingly available, and these units can be combined into integrated information system environments. These new developments offer the potential for savings, especially in the area of business process management.

Traditional organizational structures were functionally divided, but they had a central orientation. These organizations were often dependent on the limited possibilities of centralized host environments, which led to increasing business process inflexibility. In the beginning, few people realized or paid attention to the new potentials opportunities that were made possible by the increasing decentralization of computers and computer services as well as to the new information system architecture concepts (e.g. client/server, workflow management).

Today, intensifying competition has forced these potential opportunities into the forefront. Flexible structures, which persistently focus on internal business processes, have become the decisive competition factor for many companies. Only a holistic view of all business processes enables a company to recognize, streamline and support interconnected processes through optimized information system environments. Compared with the management of centralized business environments, however, the management of these new structures is far more complex. In this context, clearly and uniformly defined responsibilities, maximum transparency of structures, a homogenous communication basis integrating all company levels, and streamlined project management is vital for success.

The methods of business modeling offer support for mastering these complex tasks. Business models are a crucial prerequisite for analyzing business processes, bringing projects in line with the overall company objectives, and finally for finding the perfect information structures in the form of a compound of distributed, integrated systems to support lean organizational structures.

Modeling the company's actual situation — and, in doing so, increasingly examining holistic business processes — is now in the foreground for discussion. The increasing availability of different modeling methods does, in fact, add to this trend. The enormous multitude of methods, however, also leads to increasing complexity and confusion.

As a consequence, efforts were made to define standardized general concepts (architectures) for information system development and modeling methods.

One of these architectures is the Architecture of Integrated Information Systems (ARIS) developed by Scheer (1992). This architecture concept has two main objectives:

- It enables the evaluation and integration of methods, concentrating on their focal points, and
- It serves as an orientation framework for complex development projects, because due to its structuring elements, it contains an implicit procedure model for the development of integrated information systems.

Such an architecture does, of course, also lead to a standardization in the use of methods. Therefore, existing and new modeling methods based on the ARIS architecture have been combined to form a holistic method for modeling business processes.

Moreover, the ARIS architecture was the basis for the development of ARIS Toolset, a tool family developed by IDS Scheer AG. The ARIS Toolset supports consultants and companies in creating, analyzing, and evaluating company business processes. The ARIS Toolset provides the necessary functionalities to record and model company business processes.

Architecture of Integrated Information Systems (ARIS)

Concept of the ARIS Architecture

The conceptual design of the Architecture of Integrated Information Systems (ARIS) is based on an integration concept that is derived from a holistic analysis of business processes. The first step in creating the architecture calls for the development of a model for business processes that contains all basic features for describing business processes. The result is a highly complex model that is divided into individual views in order to reduce its complexity. Due to this division, the contents of the individual views can be described by special methods that are suitable for this view without having to pay attention to the numerous relationships and interrelationships with the other views. Afterwards, the relationships among the views are incorporated and are combined to form an overall analysis of process chains without any redundancies.

A second approach that also reduces the complexity is the analysis of different descriptive levels. Following the concept of a lifecycle model, the various description methods for information systems are differentiated according to their proximity to information technology. This ensures a consistent description from business management-related problems to their technical implementation.

Thus, the ARIS architecture forms the framework for the development and optimization of integrated information systems as well as a description of their implementation. In this context, stressing the subject-related descriptive levels results in the ARIS concept being used as a model for creating, analyzing, and evaluating business management-related process chains. Scheer (1992) describes the Architecture of integrated Information Systems in more detail.

Descriptive Views

The analysis starts with a business process like the one presented in Figure C.1.

The process is triggered by the Customer order arrived event. This event in turn initiates the Customer order received function (process). Status descriptions for the relevant process environment are necessary in order to execute this operation. This includes in particular data specific to the customer and the item. The statuses of the environment objects can be changed during workflow processing, for example, if the stock inventory data of the item are updated with the new reservation data.

Sales employees who can again be assigned to departments carry out the procedures. The department uses specific information technology resources (personal computers, printers, etc.) to perform its tasks.

The confirmed order is the result of the Customer order received procedure (Order is confirmed) that now triggers further procedures (Track order, create production plan). In return, numerous status descriptions as well as human and technical resources are necessary to process these operations. These resources can be related to components of other processes. Thus, it is possible that the same status descriptions are required or the same resources are used.

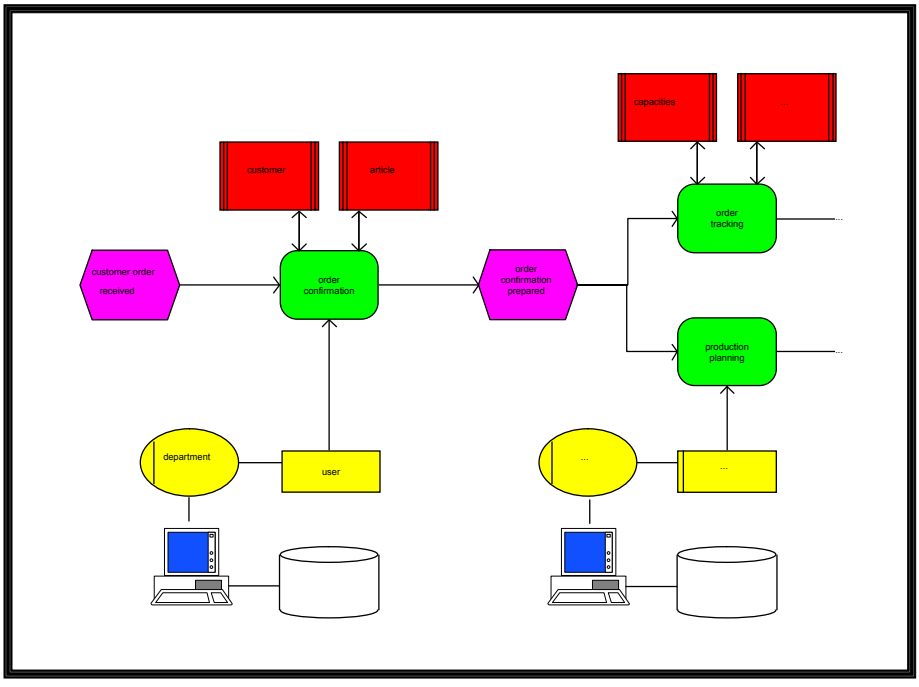

Figure C.1: Model of a Company Business Process

The components necessary to give a full description of a business process include functions, events, statuses, users, organizational units, and information technology resources. Considering all the effects on all the elements of the process for every event would severely complicate the model and lead to redundancies in the description.

In order to reduce this complexity, the general context is divided into individual views that represent separate modeling and design aspects. These views can be processed largely independently of each other. The views are divided in such a way that relationships between the components within a view are very high while those between the views are only relatively loosely linked.

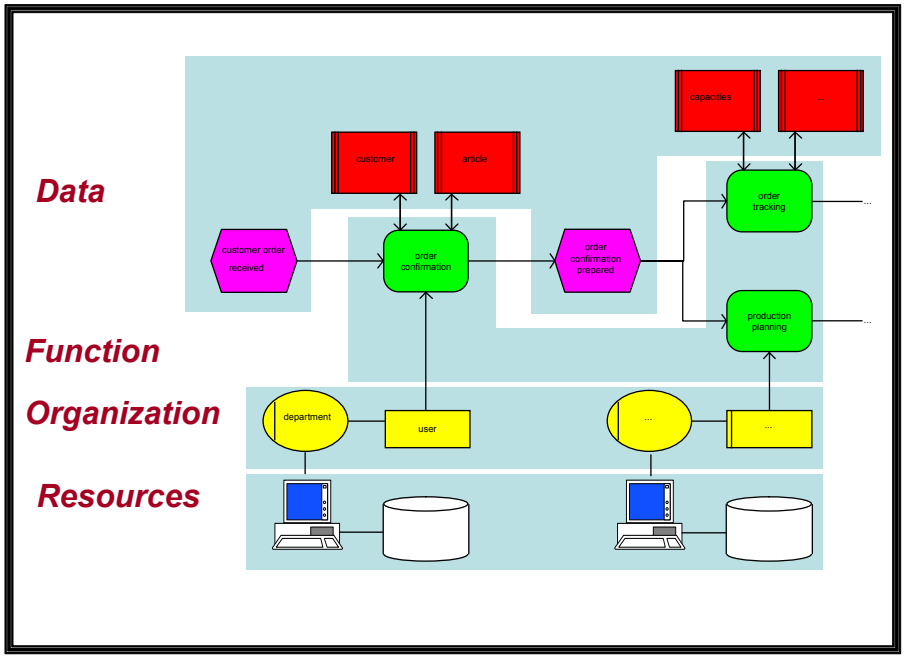

Figure C.2: Views of the process model

Events, such as customer order received or Invoice issued, define changes in the status of information objects (data). Reference field statuses, such as customer status or article status, are also represented by data. Because of these distinctions, status and events form the data view of the ARIS architecture.

The **functions** to be performed (processes) and their interrelationships with each other form a second organizational view, the function view. It contains the description of the function, the enumeration of the individual sub-functions that belong to the overall relationship and the positional relationships that exist between the functions.

The **organization view** represents a combination of the users and the organizational units as well as their relationships and structures.

Information technology resources constitute the fourth descriptive view, the **resource view**. This view, however, is significant for the subject-related view of business processes only insofar as it provides general conditions for describing the other components that are more directly geared towards business. For this reason, the component descriptions of the other views (data, functions and organization) are described by their proximity to the

information technology resources. Thus, the resources are dealt with at the data processing descriptive levels and in the implementation of the other views. The lifecycle model defined by the analysis of the different levels thus replaces the resource view as an independent descriptive object.

Breaking down the process into individual views reduces its complexity—albeit at the expense of the relationships between the process components of the views. For this reason, the **control view** is introduced as an additional view in which the relationships between the views are described. The integration of these relationships within a separate view makes it possible to systematically enter all the relationships without any redundancies

The control view is an essential component of ARIS. This is where the ARIS concept differs mainly from other architecture proposals (for comparison with other architecture proposals see Scheer, Architecture of integrated information systems).

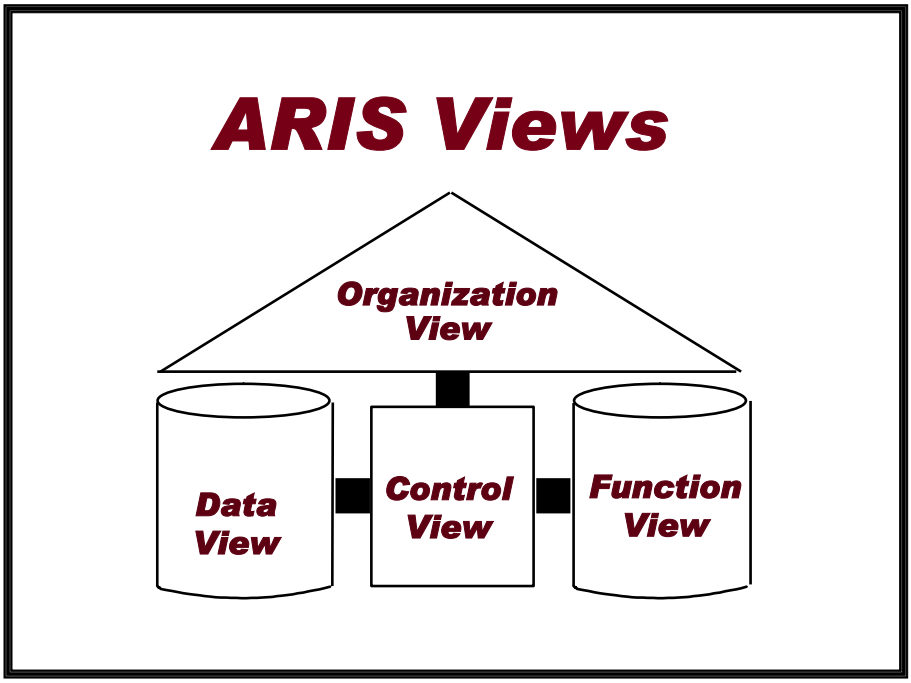

Figure C3: ARIS Views of the Business Process Model

Appendix

D Appendix D - Examples Architecture

OV-6 Single Army Operational Value Chain

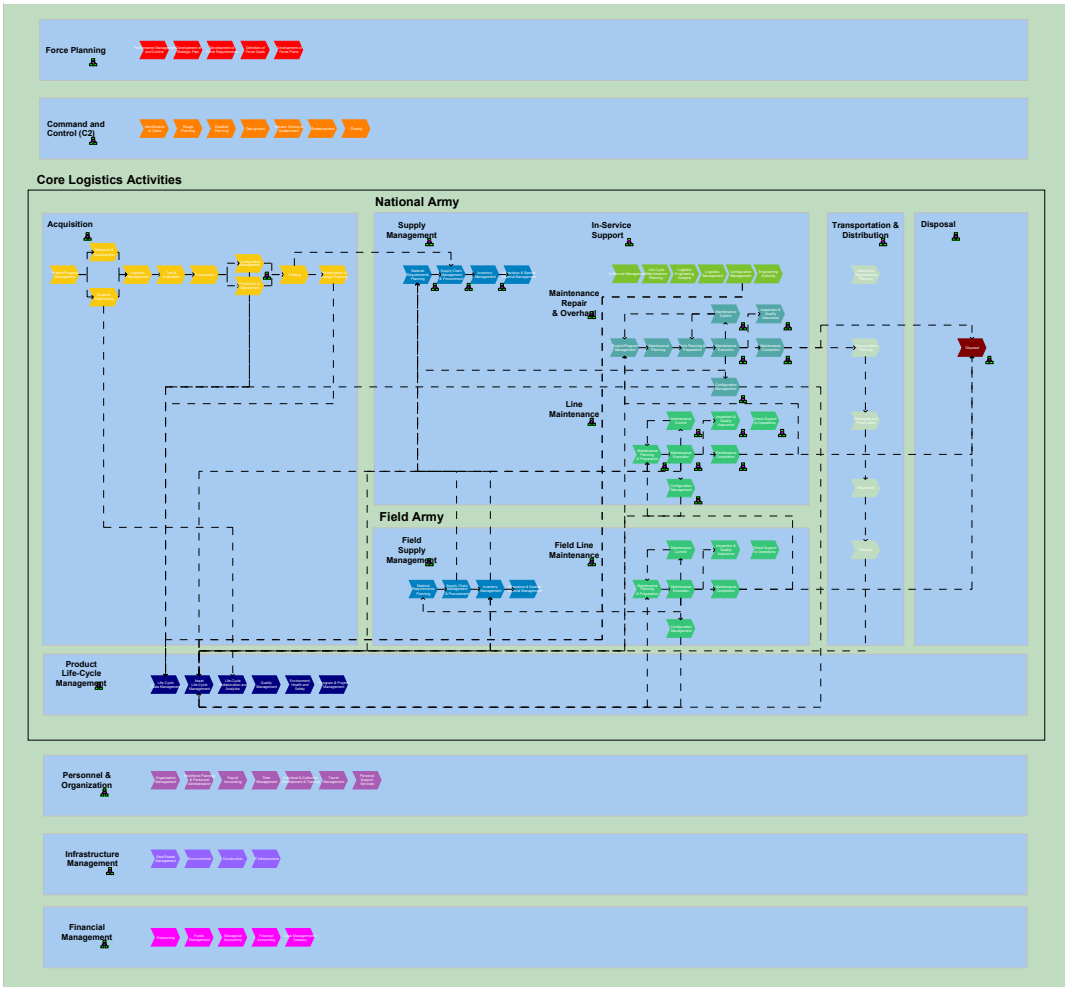

Figure D.1: OV-6 Single Army Operational Value Chain

OV-4/SV-5 Army Operational Relationships and Information Exchange

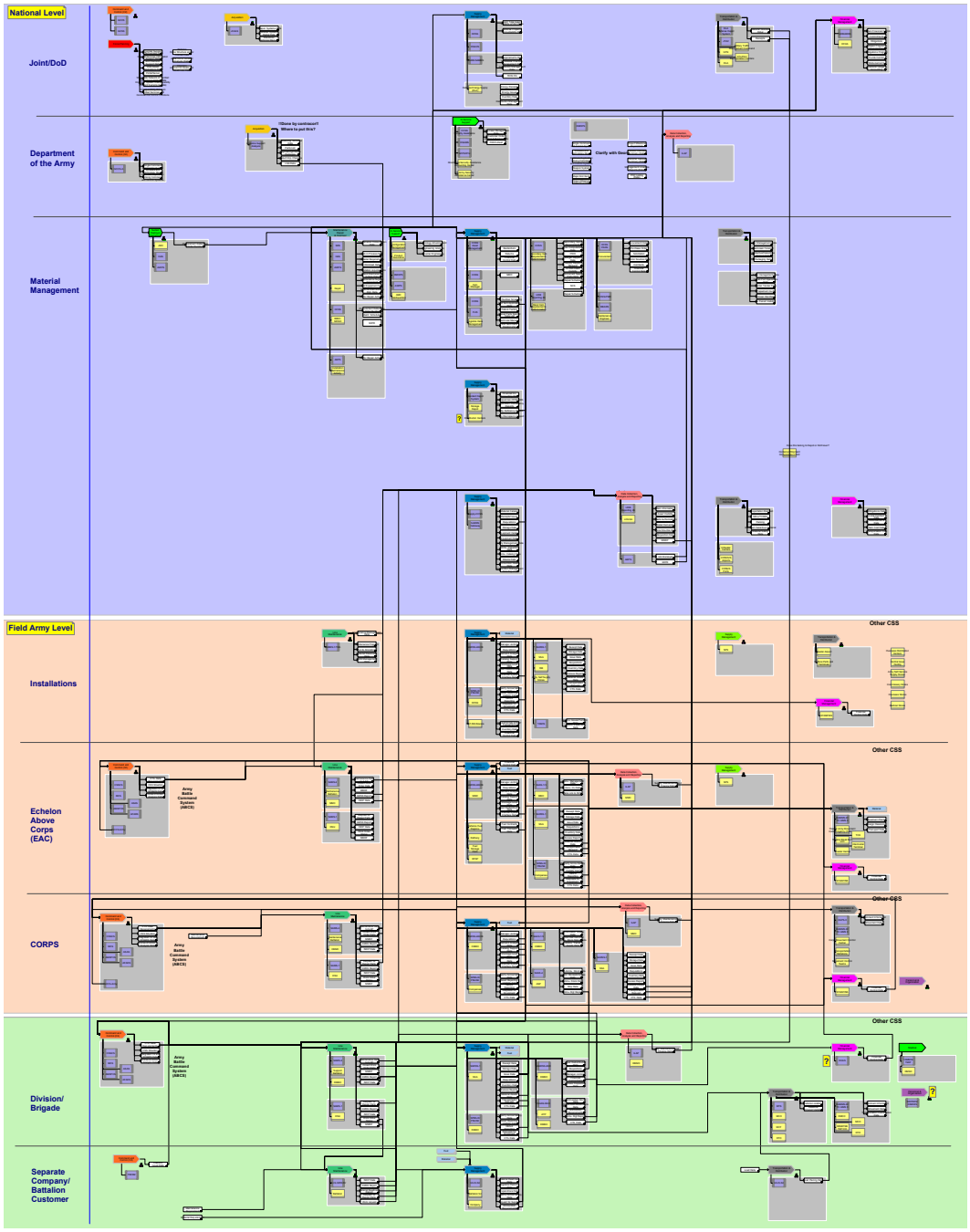

Figure D.2: OV-4/SV-5 Operational Relationship and Information

OV-5 Single Army Enterprise Activities

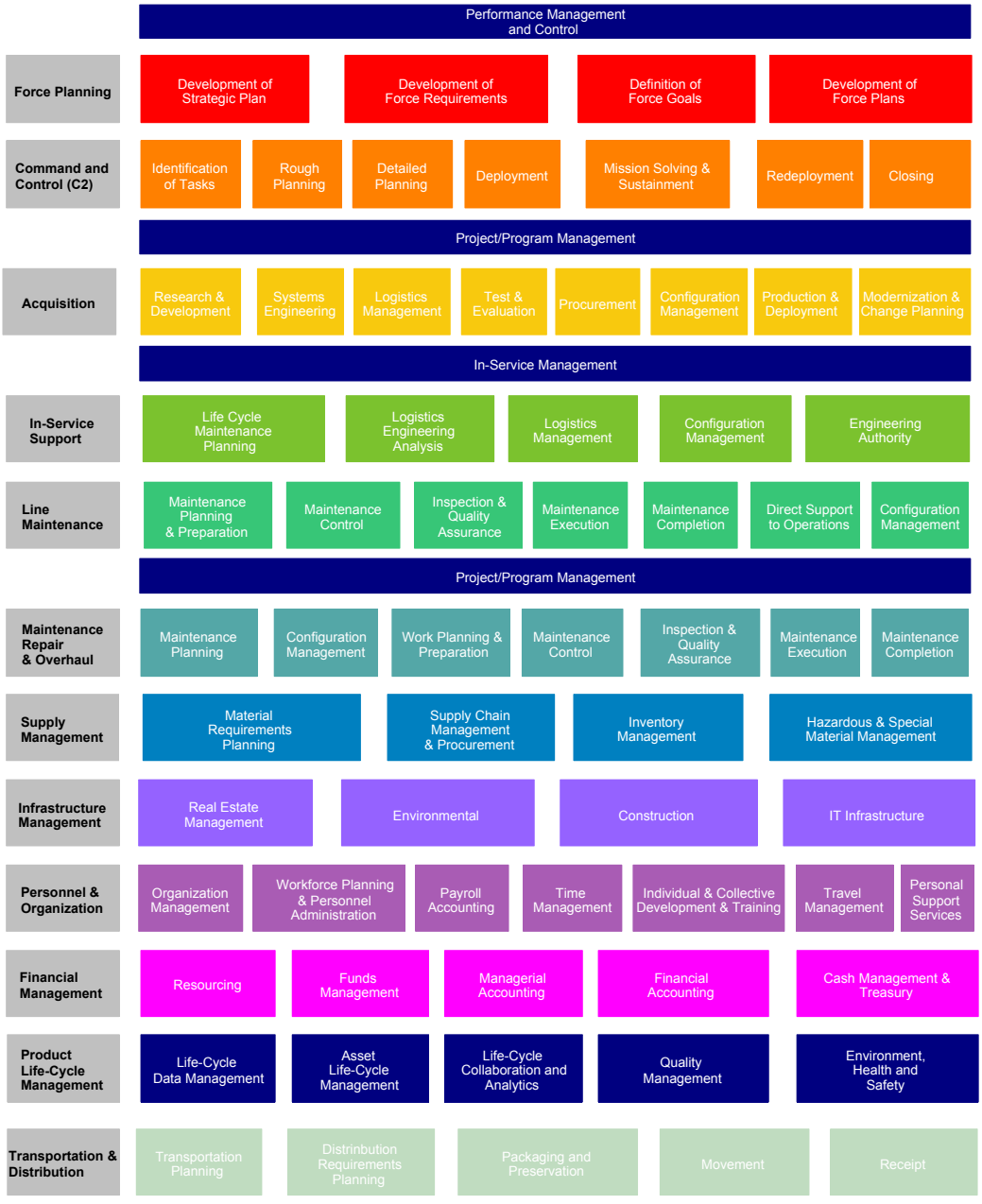

Figure D.3: OV-5 Single Army Enterprise Activities

SV-1/SV-3 Army System Interfaces and Systems Matrix

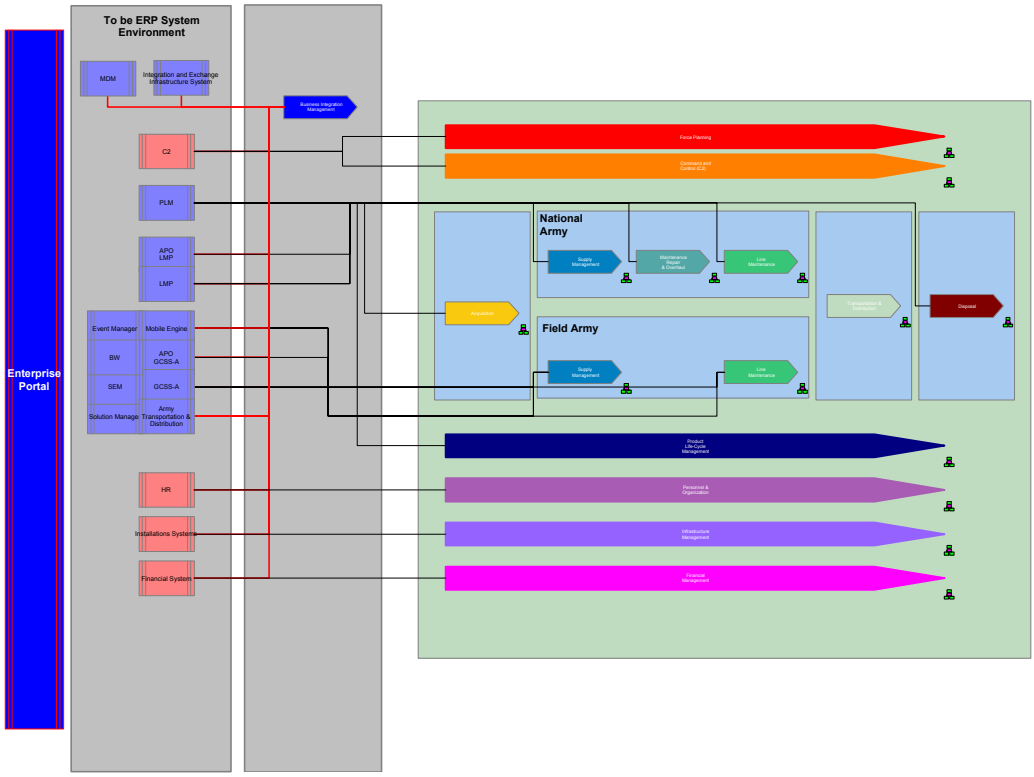

Figure D.4: SV-1/SV-3 Army System Interfaces and Systems Matrix

Appendix

E Appendix E – Acronym Glossary

AIT:	Automated Identification Technologies
ALE :	Application Link Enabling
AMC:	Army Materiel Command
ARIS:	Architecture of Integrated Information Systems
ARNG:	Army National Guard
ASPA:	Accelerated SAP
BAPI:	Business Application Program Interface
BOR:	Business Object Repository
BPA:	Business Process Architecture
BPML:	Business Process Master List
BW:	Business Warehouse
C2:	Command and Control
E2E:	End-to-End, as in End-to-End Distribution
EAI:	Enterprise Application Integration
EIDE:	Enterprise Integrated Data Environment
ERP:	Enterprise Resource Planning
IDE:	Integrated Data Environment
IDOC:	Intermediate Document
IKE:	Integrated Knowledge Environment
IMA:	Installations Management Agency
JDBC:	Java Data Base Connectivity
JMS:	Java Messaging Service
LDSS:	A collection of software services that support maneuver sustainment within the Unit of Action

LSI:	Lead System Integrator
MDM:	Master Data Management
MDS:	Master Data Server
ME:	Mobile Engine
MES:	Manufacturing Execution System
NAM:	National Asset Manager
PBL:	Performance Based Logistics
PLM:	Product Lifecycle Management
PLM+:	An instance of SAP Product Lifecycle Management, augmented with a NetWeaver hub.
PM:	Program Manager
Q&Adb:	Question and Answer Database
SBCTL:	Stryker Brigade Combat Team
SDE:	Service Data Environment
IT:	Information Technology
LMP:	Logistics Modernization Program
MES:	Manufacturing Execution System
MRP II:	Manufacturing Resource Planning II
RDBMS:	Relational Database Management System
SME:	Subject Matter Expert
UA:	Unit of Action
UE:	Unit of Employment
USAR:	U.S. Army Reserve
VM:	Virtual Machine
WLMP:	Wholesale Logistics Modernization Program (Obsolete; now LMP)
WMI:	Warfighter Machine Interface
XI:	Exchange Infrastructure